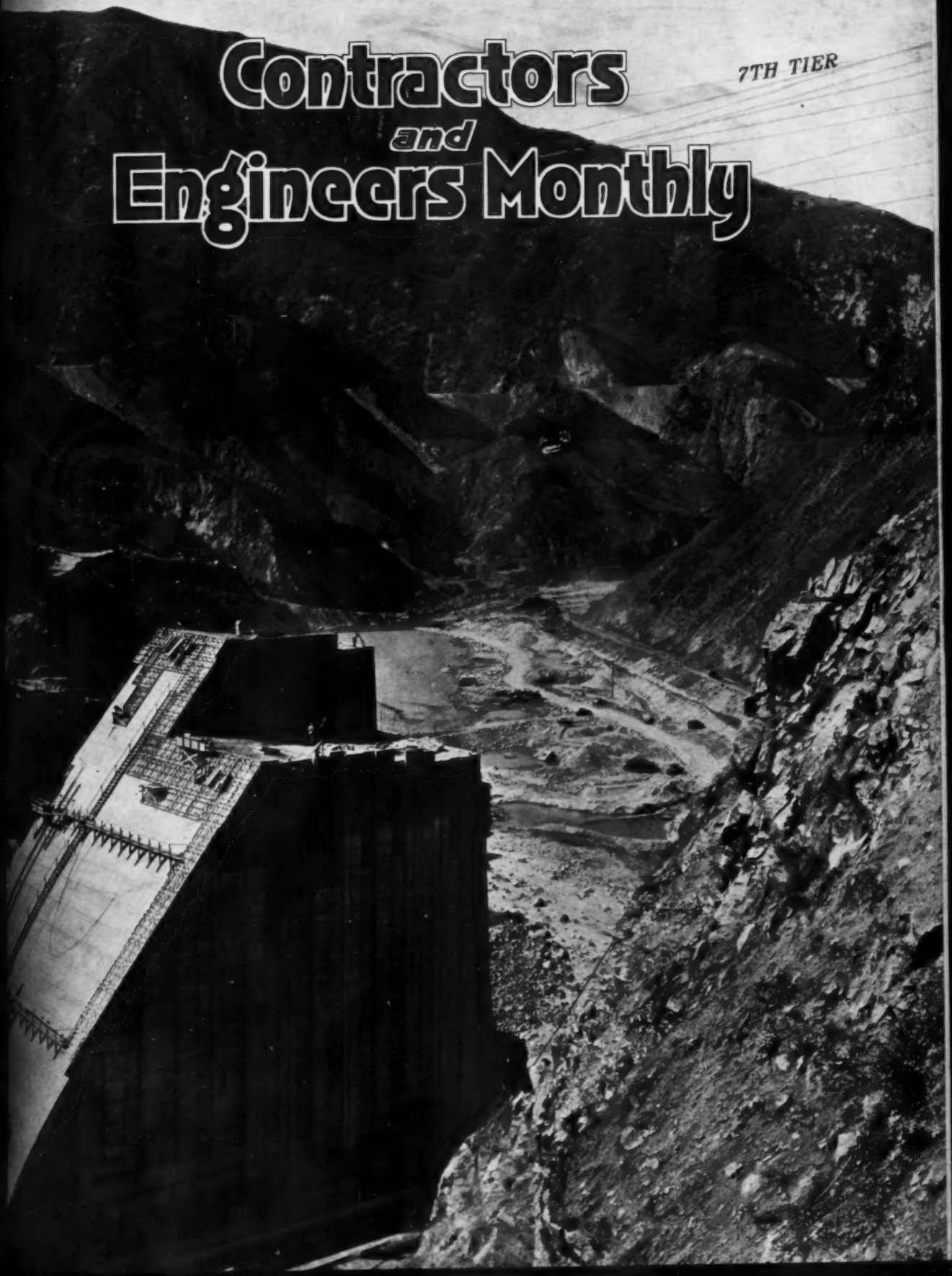
AUGUST, 1933
25 Cents, $1 a Year

Contractors and Engineers Monthly

7TH TIER



TU-WAY SAVES 25%

Versatility of Euclid Tu-Way Effects Important Saving On Stripping Job

THESE JOB FACTS relate interesting economies of the Euclid Tu-Way, in removing over-burden from a silica sand pit, operated by the Miller Coal and Silica Sand Co., Burnham, Pa.

FACTS OF THE JOB: Tu-Way used where bottom dump wagons were formerly operated. Loaded with a Marion 450 electric shovel and hauled by a "Caterpillar" Sixty. Length of haul averages about 600 feet . . requiring 10 minutes for a round trip; 5 minutes for loading and 5 minutes for hauling and dumping. The load is spilled while the tractor is in motion, spreading out over the edge of the fill. This feature alone saves considerable time, for nearly all rehandling is eliminated. Material is sandy clay, plus 30 per cent boulders . . eight buckets of 1¼ yd. capacity, well heaped, make up the average load.

JOB RESULTS, according to the checked records of the operator, show the Tu-Way hauling 25 per cent more material as compared to the previous equipment with proportionate savings in operation costs. Such savings are important and are due to the versatile features incorporated into the design of this unusual Unit. The Tu-Way will speed up operations and cut costs on many varied jobs. Send for the folder that gives the Facts.

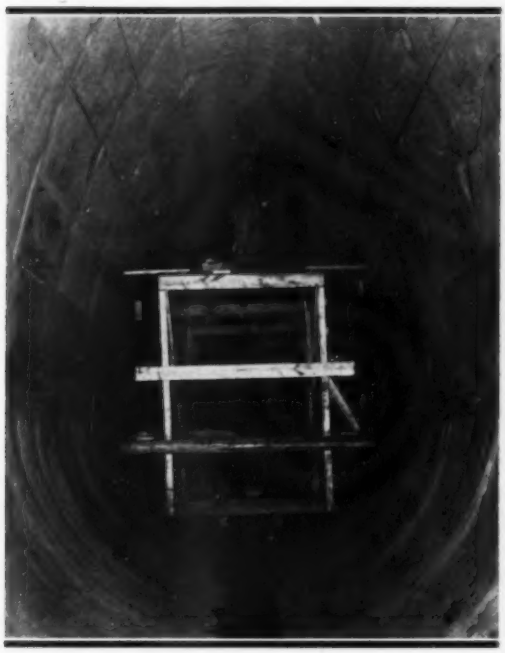
Turns in a road-way width of 22 ft.

Spreads as it spills, saving rehandling

THE EUCLID ROAD MACHINERY COMPANY

CLEVELAND OHIO

The Mill Creek Trunk Sewer



Arundel Corp. of Baltimore, Md. Built Large Inverted Egg-Shaped Sewer for Louisville, Ky.

ONE of the largest pieces of public construction in Louisville, Ky., is the Mill Creek trunk sewer built from the proceeds of a $10,000,000 bond issue voted in November, 1928. The 6,800-foot section awarded to the Arundel Corp. of Baltimore, Md., involved some very interesting methods, the details of which will be described in this article. The Arundel section ran from Oleander Street to Ashland Avenue on Taylor Boulevard, a wide thoroughfare which gave considerable freedom to the contractor in handling his equipment; thence on Ashland Avenue to Peachtree Street and thence on Peachtree Street to Bicknall Avenue.

The gross bid of the contractor was $752,315.89 which included a $25-a-day bonus and penalty clause, with the contractor giving his construction time as 300 working days. The sewer is an inverted egg-shaped structure, this type having been determined by the Engineering Department of the Commissioners of Sewerage as the strongest during all stages of construction and use. The section is in three sizes: 3,955 feet of the largest size, 13 feet 6 inches wide by 20 feet 3 inches; 2,769 feet of the intermediate size, 12 feet 8 inches by 19 feet; and 150 feet of small size, 8 feet 4 inches by 12 feet 6 inches. The shell thickness of the three sizes are; for the largest, crown 16½ inches, invert 21½ inches and sidewalls 16½ inches; for the intermediate size, crown 14 inches, invert 17½ inches and sidewalls 14 inches; and for the smallest size, crown 10 inches, invert 16½ inches and sidewall 10 inches.

Large Test Pit First Work

In early October, 1931, the Arundel Corp. started work on this section of the sewer. The first activity was a test pit to determine the ground water conditions and the best way of handling them as this contractor had had no previous experience in the Louisville district. The pit was excavated 26 x 30 feet in plan at the top and 20 x 20 feet in the bottom lift to a total depth of 42 feet. An 8-inch centrifugal was installed in an open sump in the pit with a 4-inch self-priming centrifugal to handle low water and to act as a priming unit for the larger pump. The test pit showed the character of the subgrade and the fact that there was a lot of water to contend with. The top 12 feet of the soil is a clay and the remainder a good sand.

As an additional study of the ground water conditions, a gravel wall well of the Layne & Bowler type was driven 200 feet from the test pit along the line of the sewer trench. The ground water level which was origin-

Driving Soldier Beams

ally 13 feet above subgrade was taken down 9 feet by the gravel wall well. It was decided for the remaining 4 feet that it would be necessary to lower the water level with well points. The specifications required that the ground water be held constantly 12 inches below the invert of the sewer during construction.

The four deep well pumps on the job had 18-inch casings and screens and were installed at 400-foot intervals and discharged through Armco 12-gage, asphalt-coated, spiral-welded steel pipe which was delivered in 40-foot lengths. A total of 4,000 feet of this pipe was used on the job. Its flexibility made it particularly useful on this contract where it could be easily swung to one side or the other of an obstacle on a long sweeping curve.

THE START OF EXCAVATION

Actual excavation of the sewer trench was started October 26, 1932, at the north or outfall end of the contract. A P & H No. 700 backhoe with a 1¼-yard bucket excavated to a depth of 12 feet through the clay and as closely to the line of the trench as practicable. As the trench progressed, 20-foot lengths of 2 x 10-inch wood sheeting with 3 sets of 10 x 10-inch wales and braces were set up and the sheeting driven with a No. 1 McKiernan-Terry sheeting hammer. Air for the sheeting hammers was furnished through a 2-inch line by two portable compressors, a 330-foot Davey and a 220-foot Chicago Pneumatic, connected in tandem. While this was in progress the balance of the excavation was taken out with one or more P & H No. 600 cranes with 1-yard Williams clamshells. There was a sheeting hammer on each side and three men below guided the lower ends of the sheeting to insure its being plumb. The excavation was carried to a depth of 18 feet by this method and then a horizontal 12 x 12-inch Carnegie H-beam was set as a wale with 12 x 12-inch timber braces. These timbers were gained into the H-beam to insure perfect bearing.

Leads were then built on the three upper sets of wales for holding the soldier beams which were 12 x 12-inch Carnegie H-beams, 65 pounds per foot and 34 feet long. The guides were made of 2 x 10-inch timber 10 feet long securely nailed along the braces and then 2 x 10-inch cleats of proper length nailed across from the 2 x 10-inch stringers to the wales. The soldiers were driven with a No. 7 McKiernan-Terry steam hammer swung from the 40-foot boom of a Bucyrus-Erie steam crane. The soldiers were driven to 1 foot above the 12 x 12-inch H-beam wale and then 6 x 6-inch shelf angles were bolted to the soldiers, using holes already drilled, to hold the 12 x 12-inch H-beam wale securely in place.

As soon as this work was completed, the top 4 feet of dirt of the second lift was excavated below the tops of the soldier beams, using another P & H No. 600 crane with a Blaw-Knox 1¼-yard clamshell. As the excavation continued 4 x 6-inch wales were set up at 4-foot intervals between the flanges of the H-beams and 24-foot 2 x 10-inch wood sheeting driven vertically behind the 4 x 6-inch wales. The balance of the excavation was removed as described above and the 4 x 6-inch wales inserted as the work progressed. The excavation was carried to the elevation of the haunch of the invert of the sewer and then the header lines of the well point system were laid.

THE WELL POINT SYSTEM

The headers of the well point system were all 6-inch steel pipe with cast iron flanges with taps for the well points at 5-foot intervals. The points installed were Clayton Mark well points with a steel driving point, 1½ x 36-inch strainer reduced to a 1¼-inch pipe 7 feet long as a riser. The connection to the headers was through a series of ells and nipples as follows: two street ells and a nipple, a box-type union, another nipple, an iron stop cock, two more street ells and a final nipple welded into the header on 5-foot centers. The effective area of each well point extended about 7 to 10 feet below the elevation of the header. A single well point system consisted of 240 feet of double header, i.e. with header on both sides of the trench, then a cross header was installed to which a T was connected and short sections of pipe with Dresser couplings, a Crane check valve and, just before that, a vacuum line to an air pump to keep a constant vacuum on the line. There were two complete well point systems in continuous operation on this job, one with an 8-inch Deming pump and the other with an 8-inch Morris pump. A by-pass line from the discharge riser to the street around to the suction side of the pump was used for priming the centrifugals when starting.

The excavated trench as it appeared ready for the sewer forms looked more like a subway trench because of the size and the absence of lower timbering and braces.

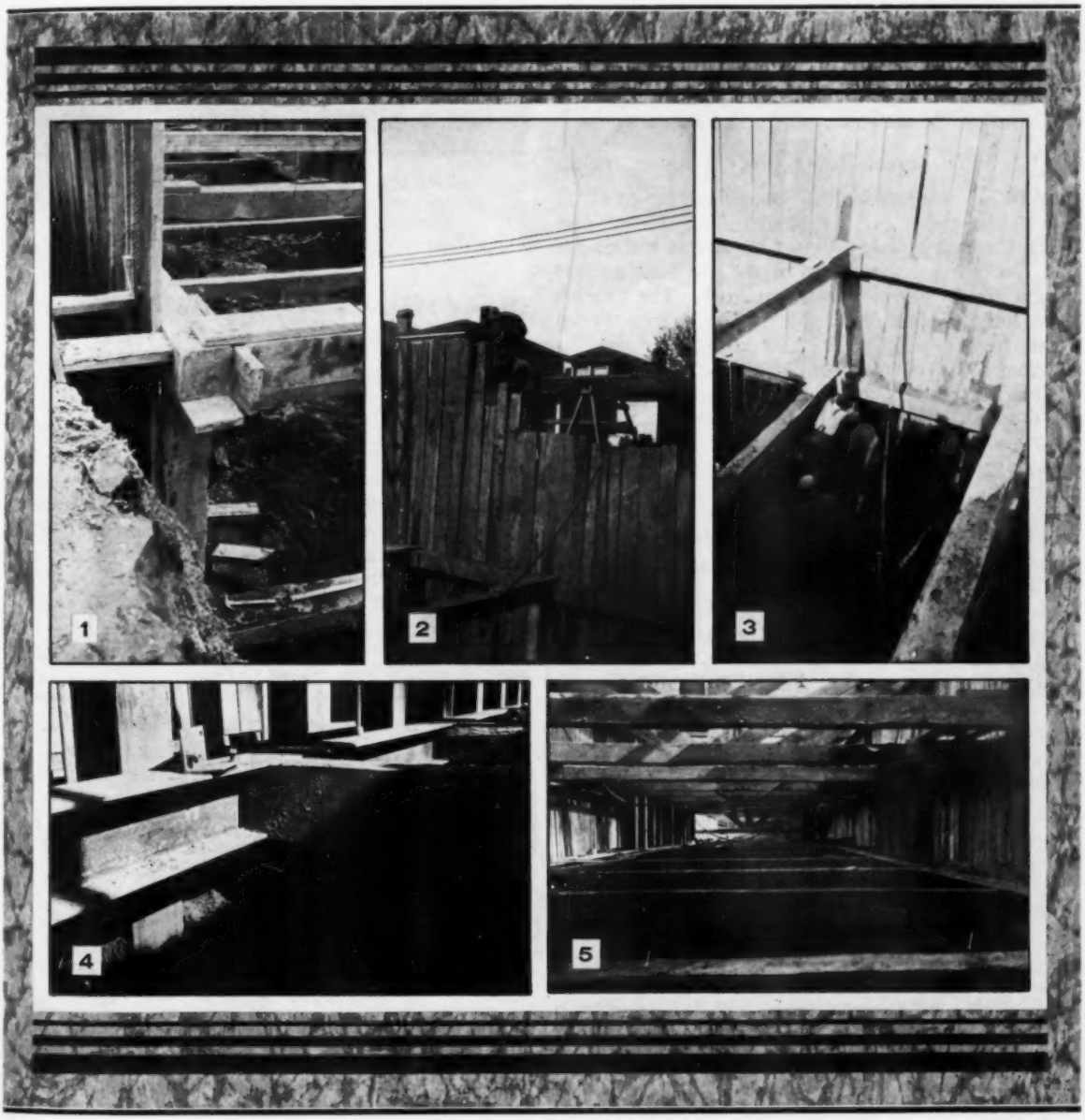
FORM WORK AND CONCRETING

Particular mention should be made of the two Universal cranes which were the jack of all trades on this job. They were constantly on the move from one section to another, ever ready to lift something or even to carry large sections of outside arch forms from the stripping to storage ahead where they were to be used next. They handled the wood side invert forms, reinforcing steel, timber, rail for the inside arch form travelers, the well point piping and innumerable other materials.

The steel invert forms were first assembled on the subgrade of the trench with the steel placed by a fast crew of eight steel men who worked as a unit, moving from one side of the trench to the other with the mini-

mum of lost motion and complete lack of confusion. The heavy side forms for the invert were wood, oiled and with heavy staples to permit easy handling by the cranes in placing, stripping and moving. A total of eight 30-foot invert sections were set up and poured as alternate units, leaving a 30-foot space between. Then the entire set was moved ahead one section and again set up. For moving them ahead a pair of 10-inch I-beams were attached to the lower set of braces and from these two sets of 8-wheel trolleys were suspended on each side and attached to the invert form. Each form had a 10-inch I-beam bolted longitudinally along each side. The carriers from the trolleys had two 10-inch channels bolted back to back with a stirrup below, which was slipped over the protruding end of the 10-inch I-beam. By means of steamboat ratchets the form was raised 2 or 3 inches to clear the concrete and carried ahead by the overhead trolleys running on the 10-inch I beams.

From information secured under similar conditions it was determined that there would be a 45-ton uplift on the 30-foot invert forms during pouring so some means had to be provided to overcome this tendency to rise. Clamps of heavy strap iron were made and affixed to the vertical soldier beams by means of hickory wedges. These clamps rested on a 10 x 10-inch timber running



SHEETING AND BRACING FOR THE SEWER TRENCH

1. *The end of a 20-foot wale showing the method of supporting the next wale to be placed.* 2. *Driving a 20-foot length of 2 x 10-inch wood sheeting with an air-operated sheeting hammer.* 3. *The bottom crew on wood sheeting.* 4. *A 12 x 12-inch brace set into a horizontal H-beam wale. Note the 6 x 6-inch shelf angle ready to be bolted to one of the soldier beams.* 5. *Top braces in place and the trench ready for the second lift.*

longitudinally on each side of the invert form. Under the timber running transversely were five or six I-beams laid on top of the longitudinal 10-inch I-beam which was used for carrying the forms forward. This scheme was successful and the uplift was negligible. These forms had a strengthening truss every 5 feet and the transverse I-beams were laid at approximately these locations to carry the load better.

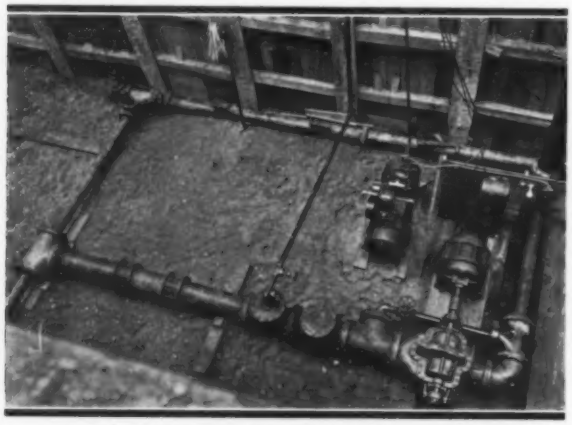
The Blaw-Knox arch forms for the inside of the sewer each had six jacks and fourteen turnbuckles, one on each side of the form at each truss, which were used to expand the form when setting it in place and for contracting it to break it away from the concrete when ready to strip and move ahead. The arch forms of non-telescopic design carried their own travelers which moved ahead on 65-pound rails set on ties cut to the section of the invert of the sewer. The invert forms were stripped in 48 hours, the outside arch forms in 48 hours and the inside arch forms in 60 hours.

CONCRETING PLANT AND PLACING

All of the concrete for this job, amounting to about 25,000 cubic yards, was furnished from a special plant of the Colonial Supply Co., set up at one end of the job. The concrete as required by the specifications was a 1:2:4 mix by volume for all the work. The location of the concrete plant required that all the aggregates and cement be hauled by truck. The sand and gravel was delivered to a 3-compartment steel hopper set about 8 feet above ground level and to which the trucks backed and dumped. The materials were raised from the receiving hoppers by a Link-Belt 100-ton capacity bucket elevator to a Blaw-Knox 3-compartment, 200-ton capacity steel bin fully enclosed and equipped with weighing batchers.

Cement was hauled in bags from Speeds, Ind., by trucks and delivered to a cement storehouse at one side of the mixing plant. The opposite end of the plant was occupied by the office and the beam scales for determining the weight of each load of concrete hauled from the plant. A window in the office permitted the weighman to see all parts of the plant and thus control the operation.

Three men operated the plant, which furnished an average of 200 yards per day. These consisted of an elevator man, a cement man and one man operating the



The Well-Point Pumping Plant With Its Neat Pipe Job

Excavation Completed and Well Points Installed Along Both Rows of Sheeting. Note the 10-inch I-beams Attached to the Lower Braces and the 8-Wheel Trolleys for Moving the Invert Forms, One of Which Is Shown in the Foreground.

1½-yard Marsh-Capron mixer. The plant was further equipped with a hot water boiler in which the water was heated by live steam and live steam jets were used in the aggregate bins to heat the sand and gravel during the cold weather. Each batch of concrete remained in the mixer at least 2 minutes, as required by the specifications.

The concrete was hauled from the plant to the forms in Avril 2-yard Tru-Batch trucks, a fleet of four being used for this work. The concrete was chuted from the trucks over the sheeting with a short section of a coal chute and then a 12-foot chute carried it to the top of the elephant trunk chute through which it dropped to the forms some 30 feet below. The concrete gang consisted of about twelve men as follows: one man dumping the truck, one man at the top chute, two men at the bottom of the chute to move it as required and to prevent its swinging during pouring, two men tamping inside the forms and two men spading on each side between the two sets of forms, as well as two extra men who were usually busy spading. Heart-shaped spades, 6 inches long and 4 inches wide with ⅝-inch round rods from 3 to 12 feet long for handles, were used for the spading of the concrete.

An interesting sidelight on the care taken of the men by the contractor is given by the special water carrier made for the use of the men between the forms. A glance at the dimensions of the arch will show that on the curve there was little space for a water bucket to be lowered between them particularly when the reinforcing is taken into consideration. Spading in close quarters in cold weather with warm concrete or in hot weather with cold concrete is a thirsty job so the contractor had a set of water containers made with screw tops and holding about a gallon of water each which could be lowered between the forms to the men who were spading.

A finishing scaffold within the sewer permitted the men to plug all cone bolt holes and leave a smooth.

clean interior. This scaffold, which is shown in the first illustration, was mounted on two sets of trailer wheels and axles, the latter bent to conform to the curve of the invert of the sewer so that the wheels were perpendicular to tangents of the curve of the sewer at the points of contact. The scaffold was so well designed that it would roll along through the completed sewer without being pushed because of the grade of the invert. For this reason it had to be blocked when the men were working so that it would stay in one place.

BACKFILLING

Sand from the lower lift of the excavation was carried back and used as backfill. The lower lift of backfill around the haunch of the sewer barrel was placed by timber chutes from the top to the peak of the arch where it divided and fell around both sides of the arch. This backfill was all puddled, using water from the deep well pumps carried back in a 2-inch line by a Carter Humdinger pump. In hot weather this water was also used for sprinkling the concrete arches to keep them moist and increase the strength of the concrete. This line also provided water for the steam crane and for washing the forms as they were stripped. T's spaced 40 feet apart provided convenient connections for the necessary hose. After the backfill was carried up to the under side of the lower brace and the 4 x 6-inch wales between the soldiers had been removed as the fill progressed, the lower brace was removed and 3 feet of backfill placed over the top of the structure. Then the wood sheeting was removed and lastly the soldiers taken out by inverting the No. 7 steam hammer. The balance of the trench was then filled in layers approximately 3 feet thick and when full the top set of sheeting removed by a No. 204 P & H crane which was kept on the backfill at all times, after which the trench was finally settled by water jets penetrated about 12 feet.

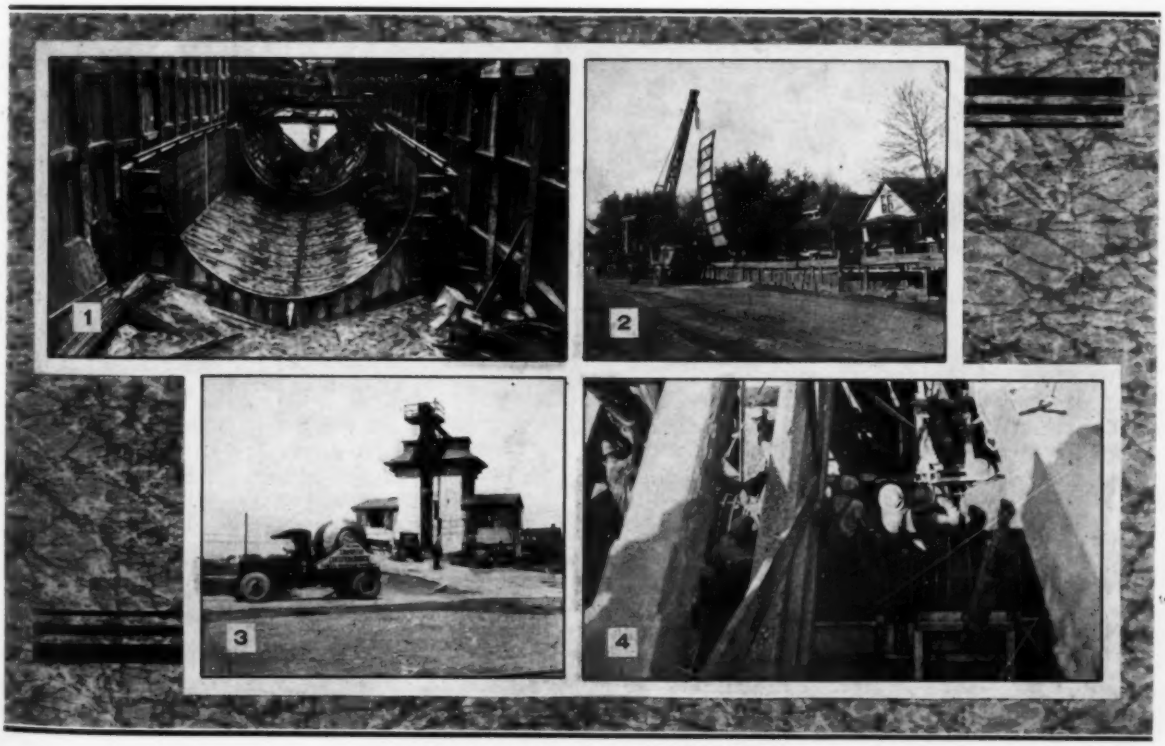
HANDLING A CROSS SEWER CONNECTION

At one point in the trunk sewer it was crossed by a 6-foot x 6-foot 8-inch semi-elliptical sewer which had to be carried from above during construction and later cut open to make a connection with the new sewer. As the excavation for the new sewer was carried down and reached the top of the cross sewer two pairs of 12-inch H-beams were installed with 1¼-inch suspender rods on 6-foot centers. These were bent to the shape of the invert of the sewer and slipped under the invert as soon as it was reached and then attached to the 31-foot H-beams by ⅝-inch plates and nuts. The top of the sewer was later broken out and a weir installed to permit all flow in the top sewer over a predetermined amount to enter the new trunk sewer. The form work for this required the services of two carpenters for about six weeks, with slight interruptions for other more urgent work.

SELECTION OF LABOR

The provisions of the contract permitted the contractor to bring into Louisville a total of five men, the remainder of the employes being required to be local labor from within the corporate limits of the city. The

(Continued on page 18)

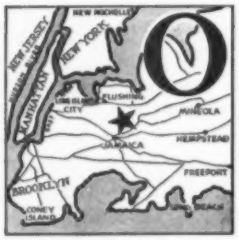


FORM SETTING AND CONCRETING

1. The reinforcing crew setting the steel in one invert form. 2. One of the handy truck cranes moving a section of the top arch forms. 3. One of the four agitator trucks which hauled the 25,000 cubic yards of concrete for this sewer. 4. Pouring an arch. Note the delivery chute at the left and the spaders at work as closely spaced as possible. In addition two men continuously tamped the forms from the inside during pouring.

Working a Maximum *of* Men *to* Overcome Unemployment

Garofano Construction Co., Inc. Used Local Labor on Long Island, N. Y., Federal Aid Project



ONE of the first Federal Aid projects in New York State to be financed by money made available by the Emergency Relief and Construction Act for 1932, was a 3.81-mile reinforced concrete highway in Nassau County, Long Island, consisting of a 4-strip pavement on the main highway, 8 inches thick. This contract was awarded September 10, 1932, and was completed prior to January 1, 1933. The contract was known officially as Federal Aid Project on the Northern State Parkway, Section 1-B and approaches. The contractor was required to employ all common labor through the local unemployment registration board and, through the restrictions of the Emergency Relief and Construction Act, was required to perform certain operations by hand labor instead of by machine. He worked two crews each week, with each crew working three 10-hour shifts to complete its allowable 30 hours of work per week in order to secure the maximum of production with more or less green labor. Such operations as the cleaning and oiling of equipment were performed at night under the light of National carbic flares, which were also spotted on the job to permit finishing the slab after dusk.

Rough Grade Operations

As this project had been generally graded the previous year, there were only a few places where a slight change of line necessitated heavy grading. In general the rough grade varied from 3 to 4 inches below final grade to 8 inches above. A 1-yard Northwest power shovel and a 1-yard Speedcrane, each with a pit man and three trucks per shovel, were used for the sections of heavy grading. No rock was encountered, the area being generally a glacial terrain. International and Mack trucks made up the dirt-moving fleet. The grade was shaped with a Galion power grader with an 8-foot blade and a Warco Road Hog. A disc plow was used on the shoulders to pulverize the material for easy handling. All fill was rolled with a Buffalo-Springfield and a Huber roller. Where the gravel was hard packed along the form lines, it was loosened with scarifiers on the rollers.

The form trenches were prepared by four laborers, two on each side, and two additional men on each side set the 8-inch Blaw-Knox forms.

Fine Grading and Setting Expansion Joints

A crew of four men from the unemployed labor group handled the fine grading between forms, followed up by three men working with a scratch-board to check the grade. The second fine grade crew also tamped the forms and one extra man set the ¾-inch Carey Elastite expansion joints, watered the subgrade and oiled the forms. The expansion joints were set at intervals of 76 feet 6 inches.

The expansion joint, which was carried by a cap with a 5½-inch leg on one side and a 2½-inch leg on the other, was held in place with two stakes on the side toward the paver and four stakes on the far side. The 2-foot dowels, five of which were placed through holes in the expansion joint, were supported on the far side with metal sleeves which were turned down at the end to hold the dowels horizontal. No chairs were used on the near side as will be seen in the photograph of a typical joint set-up ready for pouring.

Batching for the Road Slab Concrete

All batches for this project were made up at the Bayside, Long Island, plant of the Colonial Sand & Gravel Co. with 1,292 pounds of coarse stone, 1,060 pounds of fine stone, 1,405 pounds of sand and 658 pounds of cement. The stone was trap rock from the Clinton Point plant of the New York Trap Rock Co. on the Hudson River. A Butler bulk cement plant was used for batching the cement which was delivered to the trucks through a heavy rubber tube which was lowered directly onto the batch to prevent undue spreading. A fleet of twelve heavy-duty trucks with dual pneu-

matic tires hauled four batches per load from the plant to the Rex 27-E paver on the road.

POURING THE SLAB

At the paver one man handled the dumping of the individual batches from the trucks into the skip of the paver and signed the delivery checks for the truck driver and another man climbed onto the truck and cleaned out each separate batch, in case damp sand had clung to the body or floor of the truck. The paver, which ran along an adjacent slab, carried a wooden platform beneath the bucket to catch any grout which might leak from the bucket during loading. A crew of four puddlers and two spaders spread the concrete and all six pulled the strike-off which leveled the concrete 2 inches below the top for the placing of the Kalman steel reinforcing. As soon as the top 2 inches of concrete was spread an Ord finisher screeded the top to a uniform surface. In addition to the finisher operator, two spaders worked along the forms and also shoveled concrete to the screed in low spots. The Ord finisher used a double-flange wheel on one form and a single-flange wheel on the side against the slab. This was cramped a bit away from the slab to prevent spalling. As this road contained a series of banked curves, the double flange was necessary as a safeguard against the machine working over against the concrete.

Immediately behind the finisher two men were busy cleaning the slab. One of these was hand finishing directly behind the machine. A Heltzel twin rolling bridge was used by two finishers for operating the 16-foot longitudinal float. These same two men used a board belt, dragged the burlap over the surface to give a uniform appearance after finishing; then one man broomed and edged the surface and two men on part time placed the burlap.

These operations were duplicated by a second paver and crew working from the other end of the contract.

CURING

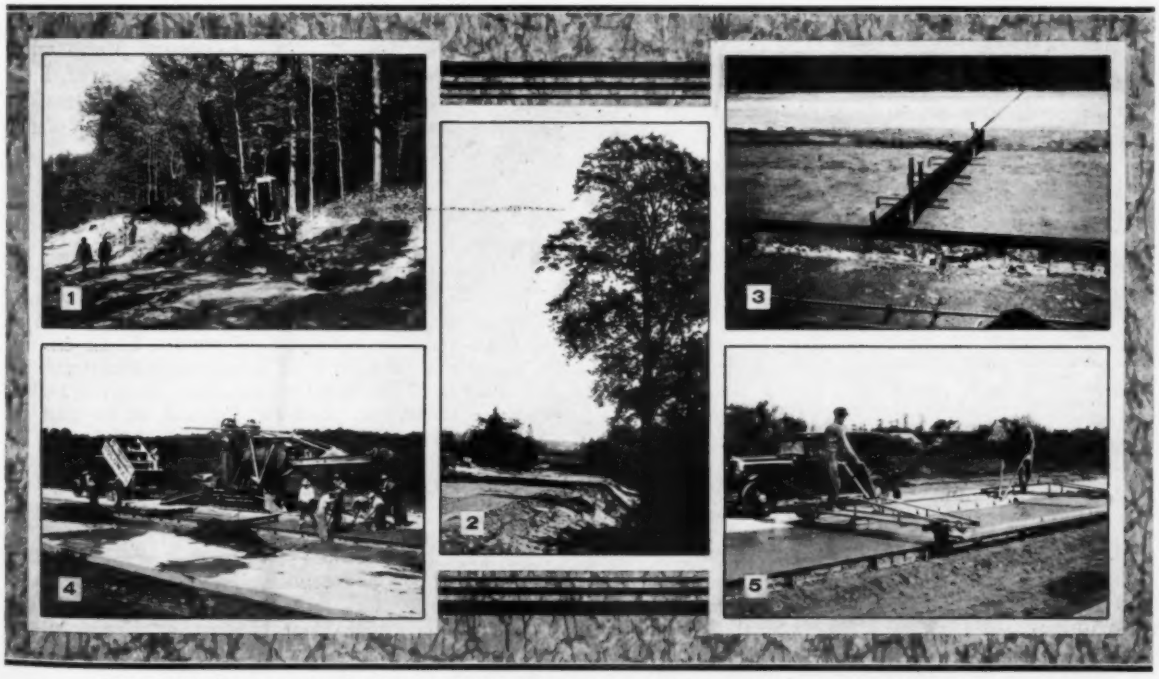
A motor truck with driver and three men from the unemployed group placed the hay the following morning in about one hour and two men sprinkled the hay for a period of seven days. This same crew stripped the forms and had them moved ahead by 11 o'clock each morning. A crew of six men, also from the unemployed group, were used to move the hay from one slab to another where required.

COUNTY SYSTEM SUPPLIED WATER

The Nassau County water supply was used to supply the lines for both sprinkling and mixing. A Rex triplex pump centrally located was used as a booster on the line, the first 8,000 feet of which was a 2½-inch pipe and the remainder 2-inch pipe with taps placed every 200 feet. The paver carried 400 feet of 1½-inch hose to supply the mixing water.

TRUCK MIXERS POURED CURB AND GUTTER

The contractor chose to pave the two outside 12-foot strips of concrete first so as to be able to pour the curbs while the two inner 10-foot strips were being poured. Premoulded expansion joint was placed between the curb and the slab. A special crew of four men set up the Blaw-Knox curb and gutter forms for 2,000 feet before pouring with the truck mixers began. The Colonial Sand & Gravel Co. hauled four batches of dry



GRADING AND PAVING THE EXTENSION OF A STATE PARKWAY ON LONG ISLAND, N. Y.

1. Many stumps were loaded by the power shovel in this manner. 2. A long stretch of fine grade showing the type of flat-arch bridges on the project. 3. An expansion joint set on the grade ahead of the paver. 4. One of the fleet of 4-batch trucks, the paver and concrete crew. 5. The longitudinal float—the proper method of securing a smooth riding pavement.

Concrete Pipe and Wood Forms for a Drop Inlet

aggregate and cement to a two-compartment Butler bin centrally located on the job which was used as a hopper. Mack trucks dumped two batches into the hopper which were then run into the Rex transit mixer which immediately left to pour. Then the Mack truck dumped the next two batches and was off on its way for another load. The transit mixers, which were of 4-yard capacity, carried only 2 yards in traveling over the pavement because the contractor wished to avoid any possibility of damage.

When the transit mixers reached the point of pouring, the chute was swung out over the forms and one man climbed aboard to open the rear delivery gate with the hand wheel. Four men from the unemployed group spaded and trod the concrete into place as it was delivered from the chute. These were followed up by two other men who handled the finishing.

QUANTITIES AND UNIT PRICES

Item and No.		Quantity	Price
1	Clearing and grubbing	Lump sum	$ 1,100.00
4	Unclassified excavation	73,000 cubic yards	0.10
4B	Trench and culvert excavation	1,700 cubic yards	0.40
6	Overhaul	40,000 station yards	0.005
7S	Trimming shoulders	23,500 linear feet of road	0.01
8	Preparing fine grade	112,000 square yards	0.10
10	6-inch pipe underdrain	300 linear feet	0.30
14AS	Reinforced concrete pipe 18-inch	1,200 linear feet	1.50
14BS	Reinforced concrete pipe 24-inch	700 linear feet	2.00
15B	Portland cement	42,740 barrels	1.40
15H	Special portland cement	800 barrels	2.80
20	First class concrete 1:2:4	110 cubic yards	12.00
23D	Dimension masonry	2 cubic yards	100.00
24	Stone masonry, laid dry	40 cubic yards	15.00
25	Metal reinforcing for concrete pavement	108,000 square yards	0.20
25	Bar reinforcing for concrete pavement	14,640 pounds	0.06
28	Bar reinforcing for structures	3,000 pounds	0.05
30	Miscellaneous iron and steel	64,000 pounds	0.04
32A	Rustic timber guide rail A	4,600 linear feet	0.90
32C	Rustic timber guide rail C	4,100 linear feet	0.80
32S	Resetting rustic timber guide rail	200 linear feet	0.25
47S	Cement concrete pavement	24,000 cubic yards	4.80
73A	Bituminous material T light viscosity	6,000 gallons	0.13
73A	Bituminous material T heavy viscosity	10,000 gallons	0.13
74	Bituminous material T cold application	6,000 gallons	0.13
77S	Maintaining traffic	3,000 linear feet	0.05
77P	Protection of traffic	Lump sum	500.00
92	Screened gravel L. M. No. S1 and 2	120 cubic yards	2.00
92	Broken stone L. M. No. S1 and 2	30 cubic yards	3.00
97S	Concrete curbing, special	49,500 linear feet	0.38
102AS	Special catch basins	3 each	75.00
102BS	Special manholes	2 each	50.00
103S	Changing elevated manholes and D. L.'s special	70 each	2.00
107	Timber and lumber	2,000 feet B. M.	40.00
109	Relaying old pipe	50 linear feet	0.50
110AS	Top soil	8,000 cubic feet	0.30
110BS	Placing top soil	40,000 cubic yards	0.30
111	Cinders, loose measure	2,800 cubic yards	0.80
112	Top course bituminous macadam mixed-in-place method	1,100 cubic yards	3.00
113	Maintaining existing drainage system	Lump sum	1,000.00
115	Seeding	38 acres	100.00
116	Peat moss	3,800 bales	1.20
	Total		$288,579.40

PERSONNEL

This Federal Aid project was built by the Garofano Contruction Co., Inc., of Mount Vernon, N. Y., with A. A. Woodstruff as Superintendent. For the New York State Department of Public Works, the project was built under the direction of J. J. Darcy, District Engineer and A. D. Greenman as Construction Engineer, with M. Kovar as Engineer-in-Charge.

The Mill Creek Trunk Sewer

(*Continued from page 15*)

contractor brought in the Project Manager, Superintendent, Engineer, a concrete foreman and a master mechanic. To be sure that the labor organization was entirely local labor and to check the truthfulness of the addresses of the men, monthly lists of employes were furnished to the Commissioners of Sewerage who turned them over to the police for detailed checking by house to house calls. It was found that each month four or five men had given fictitious addresses or had not been too careful about the accuracy of their statements as to their length of residence. These were discharged at once in accordance with the requirements of the contract.

There were a maximum of 130 men employed on this project. This number was practically continuous during the work except at the very start and as the project was being completed.

PERSONNEL

This Contract No. 58 was executed under the direction of the Commissioner of Sewerage of Louisville, Ky., with W. M. Caye, Technical Engineer, in charge. The contractor, the Arundel Corp., Baltimore, Md., completed the work within the contract period under the direction of L. B. Wilcox, Project Manager, L. R. Stutz, Superintendent, and Edward Kohnen, Construction Engineer. The concrete plant of the Colonial Supply Co. was in charge of C. M. Colston.

Our Front Cover

THE city of Pasadena, Calif., is building the Pine Canyon Dam near the mouth of San Gabriel Canyon at Azusa, Calif., to provide an addition to their domestic water supply. Pine Canyon Dam is to be completed December, 1933, and will contain 436 cubic yards of concrete in the dam and 34,000 yards in the spillway and appurtenant structures. The dam is 329 feet high above the lowest foundation, and 240 feet above the stream bed. It is 800 feet long at the crest and has a maximum thickness of 270 feet at the foundation. The reservoir capacity will be 39,350 acre feet. The dam is of the full gravity section plus a provision for earthquake force equal to one-tenth of gravity. The contractors are Bent Brothers, Inc., Winston Bros. Co. and Wm. C. Crowell.

The illustration reproduced on the front cover of this issue of CONTRACTORS AND ENGINEERS MONTHLY shows a Caterpillar Thirty and winch being hoisted to the top of the dam where a winch was needed to pull heavy sleds of rock. A 4-part Roebling ¾-inch steel cable was placed around the tractor and it was raised by Lidgerwood hoists operated by 300-hp General Electric motors and controls at a speed of 300 feet per minute. The high line is 2-inch lock lay American wire rope. The photograph was taken by Orville Logan Snider of Hollywood, Calif.

The Influence *of* Depths *of* Cuts *on* Highway Excavating Costs

By

H. K. Church

Formerly with Division of Management, U. S. Bureau of Public Roads, Washington, D. C.

A Study of 60 Road Projects Reveals Interesting Facts

IT is recognized that depth of cut is one of the factors which affect shovel output, but this fact is seldom taken into account in estimating and bidding. Yet it can be demonstrated that, everything else being equal, the unit cost of excavating in light cuts may easily be from two to three times greater than at a medium depth, and that the cost again tends to ascend with the height after a certain range of depth is passed. As long as fairly liberal prices were paid for excavation, failure to take these simple facts into consideration was less disastrous to contractors than with prices at present levels, or at levels likely to obtain in the future, even assuming a moderate revival of construction activity and bid prices.

Excavating Equipment

The trend in highway construction from purely location jobs to the improvement of existing roads foreshadows an evolution in the design as well as choice of excavating equipment, possibly from the prevalent power shovel with standard dipper sticks and dipper, in the direction of the same base machine equipped with special boom and skimmer scoop which, in its latest form, is known as a plunger shovel. The skim-

Sloping a Bank with a Skimmer Shovel on a Typical Highway Widening Job

mer, after it was brought out about 20 years ago, was considered suitable mainly for very shallow excavation, and as it has also proved effective for breaking up old pavements, it became extensively used for street grading and to a lesser extent for light highway grading. It was at first a small boom swing machine, but as it has since been developed by various manufacturers into a full-fledged convertible standard shovel utility and greatly improved in design and construction, its efficient operating range as to depth of cuts has proved susceptible to a marked increase.

DIPPER SHOVEL PERFORMANCE

The dipper shovel output is greatest when working in cuts between 4 and 12 feet in depth, where it is easiest to obtain a full dipper in one pass with the greatest economy of time in hoisting and crowding, and where swinging and dumping time usually is also at its lowest. Above 12 feet, there is a perceptible falling off in the yardage output of the dipper shovel, due partly to the longer reach and partly to the tendency of the bucket to fill up before it reaches the end of the pass, increasing the cycle time and spillage. Where a bank has to be sloped above 10 or 12 feet, more time is lost because the dipper teeth swing inward away from the slope, so that the material must be knocked down with the heel of the dipper and afterwards picked up in fractional dipperloads from the grade around the crawlers.

In cuts less than 4 feet deep the yardage output suffers most severely as, due to the arc motion of the dipper, two or more passes usually have to be made to get it reasonably full; and it is often necessary to work up abreast of material ahead of the dipper to facilitate filling.

Time is always lost in dumping stringy or sticky material into trucks standing on the same or a lower level; this loss is greatest in light cuts where more or less turf, long stringy weeds, grass or roots are picked up. This disadvantage is inherent in the dipper due to the fact that, when held at a medium high or low position for dumping, the door is at a considerable angle from the straight horizontal plane, so the contents rest largely against the dipper front.

SKIMMER SHOVEL PERFORMANCE

The latest types of skimmer or plunger shovel, like the dipper shovel, work to best advantage at depths ranging from 4 to about 12 feet. It has an advantage in speed of sluing, as the boom and scoop assembly, size for size, weighs considerably less than a standard boom with dipper sticks and dipper.

Time studies indicate an advantage of the skimmer of from 10 to 14 per cent in the 4 to 12-foot range. Although 12 feet is not the limit of reach with the skimmer, it is found advantageous above this height to resort to benching. It is, however, in depths from 0 to 4 feet that the skimmer enjoys its greatest advantage in comparison with the dipper shovel. Because of the straight plunger-like movement of the bucket, it is filled with one pass in a cut as light as 6 inches. This feature is extremely useful in finishing a grade or bank. Additional characteristics of skimmer utility are that it can finish a grade evenly and smoothly from ditch line to ditch line on roadways up to 50 feet wide, and that it can trim a slope equally well, quickly filling the bucket in the bank, and doing away with most of the customary hand trimming and fine grading.

HANDLING ROCK

The dipper shovel possesses distinct superiority in handling boulders which are too large to pass through the dipper. These can be picked up and poised on the top of the dipper, resting against the projecting teeth; the dipper can be held low above the truck and the boulder gently kicked or rolled off at the right spot. This is difficult with the skimmer which, therefore, is not recommended for jobs on which there is likely to be a considerable amount of large boulders and hard rock requiring blasting.

In handling softer rocks, and especially shale, decomposed sandstone, limestone, and other soft and friable rock lying in nearly horizontal strata, the skimmer is adaptable. Stiff shale, ordinarily requiring blasting if the dipper shovel is used for loading, can be easily removed with the skimmer. It has the same advantage here as when breaking up old pavement. The teeth of the bucket simply lift the horizontal layers of shale by wedge action of the teeth and lever action of the boom, so that the layers are broken up and easily forced into the bucket.

ANALYZING DEPTS OF CUTS

From the foregoing outline of the characteristics of skimmer and dipper shovels, it is apparent that in all cases, except where a considerable quantity of blasted rock and big boulders have to be handled, employment of the skimmer shovel should be given consideration in order to attain the lowest unit cost of excavation.

Although it may be advantageous to use the convertible feature of the modern crawler shovel, some study should be made of the time required in changing from one assembly to the other compared with the efficiency of one type or the other used throughout, as an aid in the choice of shovel for the job. The answer to this question is finally obtained by a few hours' study of the depths of cuts and type of material while preparing the estimates, or before starting operations. Last year the author undertook a thorough study of a large number of road projects at the request of the Keystone Driller Co.,* partly with a view to developing a method of preparing such estimate and partly from a desire by the manufacturer to know the facts and thereby be in a better position to serve contractors and engineers. Subsequently, about three months were spent analyzing cross section sheets and other data made available by the courtesy of the highway departments of Pennsylvania and Ohio.

SCOPE AND METHODS

In order to make the finding broadly applicable to the largest variety of topographical conditions, projects well distributed throughout the two states were selected

* Since the Keystone Driller Co., like many other manufacturers, build dipper as well as plunger shovel attachments, crane, and other equipment for the same base machine; i.e., the full revolving convertible shovel, they are in the position of neutrals as to choice of shovel utilities, being interested solely in helping to clarify the premises upon which the choice of methods and equipment as well as determination of cost are, or should be, made in order to serve the interests of all concerned.

for study, involving mountainous, hilly, rolling, and level country. The states of Ohio and Pennsylvania were thought to include sections typical of most parts of the United States.

Each individual cross-section of each of sixty projects was classified according to station, type (sidehill or through cut), maximum depth, average depth, and area according to depth of cut. The latter areas were arranged in three groups; viz., 0 to 4 feet, 4 to 12 feet, and from 12 feet up. The areas in each group were added together. Since cross-sections at 50-foot intervals were examined, volumes or cubic yardages in the respective groups are directly proportional to areas.

In this manner a total of 15,929 cross-sections were examined, involving a total of 2,463,000 cubic yards, aggregating 224.99 miles in length. Calculations based on this examination of cross-sections at 50-foot intervals in all cases showed remarkable agreement with the total yardage figure of the estimate made by highway departments. Likewise, the cubic yards per average mile of highway agreed closely with the respective State average figures for the period.

RESULTS OF ANALYSIS OF 60 HIGHWAY PROJECTS

Project No.	Length Miles	County	Width of Roadway	Cubic-Yard Excavation per Mile of Roadway		Distribution of Excavation According to Depths of Cuts					
						Percent of Total Yardage			Percent of Total Length		
				Full Width Roadway	Per 10-Foot Width of Rd. way	0-4 Feet	4-12 Feet	12 Ft. up	0-4 Feet	4-12 Feet	12 Ft up
						%	%	%	%	%	%
1	6.23	Lorain, O.	46	1,000	220	100	..	..	100	..	..
2	3.36	Butler, Pa.	28	1,500	540	89	11	..	99	1	..
3	2.55	Fairfield, O.	46	2,800	570	61	39	..	98	2	..
4	4.50	Ottawa, O.	46	2,900	630	100	..	..	100	..	..
5	3.69	Scioto, O.	46	2,900	630	77	23	..	97	3	..
6	1.50	Union, Pa.	28	2,000	710	73	27	..	97	3	..
7	2.67	Mercer, O.	46	3,300	720	100	..	..	100	..	..
8	4.12	Medina, O.	41	3,000	730	100	..	..	100	..	..
9	2.29	Fulton, O.	46	3,600	780	100	..	..	100	..	..
10	4.12	Shelby, O.	46	3,700	800	100	..	..	100	..	..
11	3.83	Henry, O.	52	4,200	810	100	..	..	100	..	..
12	4.14	Champaign, O.	46	4,200	910	51	49	..	95	5	..
13	3.10	Erie-Huron, O.	46	4,400	960	93	7	..	99	1	..
14	2.69	Paulding, O.	46	4,600	1,000	100	..	..	100	..	..
15	3.36	Fayette, O.	46	5,600	1,220	100	..	..	100	..	..
16	6.01	Bucks, Pa.	28	3,500	1,250	100	..	..	100	..	..
17	4.57	Mahoning, O.	46	5,700	1,240	63	37	..	86	14	..
18	.40	Butler, O.	46	5,800	1,260	100	..	..	100	..	..
19	3.17	Bradford, Pa.	28	3,900	1,390	60	40	..	93	7	..
20	2.03	Morrow, O.	42	6,200	1,480	100	..	..	100	..	..
21	1.53	Meigs, O.	46	7,200	1,560	81	19	..	96	4	..
22	3.31	Mercer, Pa.	28	4,400	1,570	97	3	..	99	1	..
23	3.91	Clarion, Pa.	30	5,400	1,800	76	24	..	93	7	..
24	2.84	Perry, Pa.	28	5,200	1,860	68	28	4	92	7	1
25	3.10	Clermont, O.	46	9,000	1,950	69	31	..	91	9	..
26	12.68	Wayne, Pa.	28	6,300	2,250	53	45	2	90	9	1
27	3.10	Indiana, Pa.	28	6,300	2,250	60	40	..	91	9	..
28	2.72	Holmes, O.	28	10,400	2,260	27	69	4	69	30	1
29	4.94	Chester, Pa.	40	9,100	2,270	69	31	..	91	9	..
30	5.52	Adams, Pa.	34	8,700	2,560	60	37	3	86	13	1
31	2.67	Berks, Pa.	36	10,900	3,030	54	33	13	85	13	2
32	5.41	Clearfield, Pa.	28	8,900	3,180	39	33	28	82	14	4
33	2.77	Cuyahoga, O.	100	32,100	3,210	71	29	..	89	11	..
34	1.80	Somerset, Pa.	28	9,100	3,250	43	57	..	80	20	..
35	7.16	Warren, O.	46	16,100	3,500	37	42	21	80	18	2
36	2.84	Green, Pa.	28	9,900	3,530	49	36	15	79	19	2
37	7.82	Bedford, Pa.	28	9,900	3,530	58	35	7	88	11	1
38	4.36	Carbon, Pa.	28	10,000	3,570	20	20	60	74	15	11
39	2.99	Tioga, Pa.	28	10,000	3,570	38	44	8	71	27	2
40	5.69	Hamilton, O.	46	16,600	3,580	23	51	26	64	30	6
41	2.31	Potter, Pa.	28	10,300	3,670	45	50	5	79	20	1
42	4.10	Sullivan, Pa.	28	10,500	3,750	57	43	..	84	16	..
43	2.76	Warren, Pa.	30	11,400	3,800	41	59	..	90	10	..
44	2.21	Jefferson, O.	48	20,000	4,160	49	10	41	93	4	3
45	1.94	Blair, Pa.	28	15,600	4,340	25	60	15	64	32	4
46	3.75	Muskingum, O.	46	21,300	4,630	20	68	12	50	47	3
47	5.28	Lawrence, O.	46	21,300	4,630	17	17	66	63	16	21
48	3.81	Westmoreland, Pa.	28	13,000	4,640	37	42	21	78	19	3
49	3.90	Erie, Pa.	34	17,200	5,050	16	34	50	63	25	12
50	8.42	Wyoming, Pa.	28	14,100	5,050	28	62	10	64	33	3
51	3.06	Carroll, O.	46	23,900	5,200	18	61	21	61	36	3
52	1.02	Clinton, Pa.	28	14,400	5,530	36	19	45	84	9	7
53	2.84	Mifflin, Pa.	34	19,200	5,640	16	66	18	59	38	3
54	3.69	Scioto, O.	46	26,900	5,850	28	41	33	67	25	8
55	4.26	Coshocton, O.	46	27,300	5,940	15	47	38	38	49	13
56	2.82	Hocking, O.	46	27,500	5,980	30	25	45	72	18	10
57	5.32	Beaver, Pa.	32	21,000	6,570	32	42	26	69	25	6
58	3.21	Washington, Pa.	28	19,000	6,780	33	49	18	72	26	2
59	1.11	Monroe, O.	46	46,800	10,170	6	21	73	40	34	26
60	2.84	Perry, O.	28	45,600	16,300	9	13	78	60	18	22
Weighted Averages				11,000	2,960	40.5	37	22.5	85	12.5	2.5

FINDINGS OF ANALYSIS

Table 1 is a summary of the findings on the sixty projects analyzed. Locations are given by designating counties, so as to give a general idea of the topography of the country. It will be found, in comparing the per cent distribution of yardage in the different depth groups in their relation to the total yardage per mile for a given width of roadway, that the figures are not always consistent. This is due partly to differences in the grading standards and partly to topographical differences in the two states and as between individual projects in the same state. For instance, one job averaging 10,000 cubic yards per mile of 30-foot roadway in regular undulating country may not have a cut in excess of 8 feet. On the other hand, a similar job in a flat country, may pass from a plain to a river and up again on the other side, and have most of the 10,000 cubic yards concentrated in two cuts upwards of 20 or 40 feet in depth.

Although these represent extremes seldom actually occurring, it is well for estimators to bear such possibilities in mind in making comparisons of specific projects, in which they may be interested, with those cited in the table. In general, however, it was found that the percentage distribution of volume of excavation in different depth groups bears a fairly uniform relationship to the total excavation per mile of roadway of a given width.

In order to facilitate comparisons of percentage distribution of volume of excavation as between roadways of different widths, yardages per mile have been reduced in the table to apply to a uniform width of 10 feet of roadway, and the projects arranged on an ascending scale in respect to total volume of excavation per mile of roadway 10 feet wide.

INTERPRETATION OF ANALYSIS

The analysis reveals for the first time the importance of light excavation on the great majority of projects, as proved by the fact that about 40 per cent of the total volume and about 85 per cent of the total linear length of all cuts in Pennsylvania and Ohio average less than 4 feet in depth. Further, that 81 per cent in Pennsylvania and 74 per cent in Ohio represent the volume of excavation taken from cuts averaging less than 12 feet in depth.

These facts must be as surprising to many contractors as they were to the investigators. Even though they do not apply to every individual job on which a contractor from time to time may be bidding, they furnish positive evidence of the need for closer analysis of depths of cuts on every project to determine the most economical method of excavation. Two methods may be followed in making such an analysis, applicable to any individual project. They are:

Method No. 1. Ascertain the total yardage on the project under consideration, and divide by the mileage to find the cubic yards per mile. Reduce the cubic yards per mile to a 10-foot width by dividing by the total width and multiplying by 10. Find two, three, or more projects in Table 1 which approximate the same volume of excavation per mile. Then average the percentage figures for these jobs in every depth group to find

the approximate percentage of light, medium and heavy cuts. They should come fairly close to corresponding with those involved in the project in hand.

For example, assume a contractor is bidding on a job with the following characteristics: length, 3.45 miles; roadway excavation, 25,600 yards; roadway width, outside of ditch to outside of ditch, 30 feet. The yardage per mile per 10 feet of roadway width is found to be 2,470. Pennsylvania projects 26, 27, 29, and 30 and Ohio project 28, approximate this figure. The distribution of excavation in the different groups, according to Table 1, is as follows:

Project Number	Percent Distribution of Total Volume		
	0-4 Feet	4-12 Feet	12 Feet up
26 Pa.	53	45	2
27 pa.	60	40	
29 Pa.	60	31	
30 Pa.	60	37	3
28 Ohio.	27	69	4
Averages.	54 percent	44 percent	2 percent

Unless visual inspection on the ground, or of the cross-section sheets, showed the job to be of a very exceptional character topographically, the contractor would be safe in determining his choice of methods and shovel utility for the job by the above figures, showing that about 54 per cent of the total volume would average less than 4 feet in depth, and 98 per cent average less than 12 feet. The skimmer shovel would be the more efficient unless much hard rock requiring blasting, or of dirt containing a big percentage of large boulders, had to be handled.

Method No. 2. Examine the cross-section sheets for the job in question. Classify each cross-section of cut at 50-foot intervals, according to depth, and its area in square feet and record them in the proper column of a form as shown below. Judgment is required in making these classifications. Thus if 50 per cent of the area appears to be in the 0 to 4-foot range of depth, and 40 per cent in the 4 to 12-foot range and 10 per cent in the 12 to 20-foot range, the entire section should be classified as in the 4 to 12-foot range. When all the cross-sections have been thus classified, each column is footed up to secure the grand totals for the job.

PERCENT OF TOTAL ROADWAY EXCAVATION ACCORDING TO DEPTH OF CUT

0-4-Foot Cut		4-12-Foot Cut		12-20-Foot Cut		20 Feet up Cut		Totals	
Area Sq. Ft.	Per-cent	Area Sq. Ft.	Per-cent	Area Sq. Ft.	Per-cent	Area Sq. Ft.	Per-cent	Area Sq. Ft.	Per-cent
90		170		300		600			
75		200							
120		140							
				TOTALS					
30,000	45%	20,000	30%	10,000	15%	6,000	10%	60,000	100%

Since volume is proportional to area, as explained under "Scope and Methods," the percentages are secured by dividing the column totals of area by the grand total of area.

It requires about an hour's time per mile of plan to make an examination as outlined. With a little experience, this time may be considerably reduced. These methods can also be applied to road widening projects, with numerous changes of grade and line, which are becoming more and more prevalent. In fact, portions of the projects analyzed were of this nature.

These suggestions which are new and offer perhaps a different slant on the problem of choosing equipment for an excavating or grading job are offered for the consideration of our readers. While low operating costs have always been of importance, this factor has assumed even more prominence in the face of the low bidding and the type of road construction characteristic of the present day.

Don't Apply to State Highway Departments for Jobs

FUNDS appropriated for highway work under the National Industrial Recovery Act are already being allotted to the various states and consequently the various state highway departments are being besieged by laborers who expect that the state highway departments will hire large numbers of men for this work. The federal regulations governing this work state that the United States Employment Service in each state will designate agencies to prepare lists of skilled and unskilled labor for each highway project. When a contract is let in a certain county, the U. S. Employment Service will select some existing relief or employment agency in that county and have it supply a list of available workers to the contractors. From this list the contractor will select his men. The Federal regulations contain this clause: "The requirements for preference in employment will not permit a contractor to carry with him skilled or unskilled laborers to any project unless they are ex-service men with dependents. War veterans with dependents are specifically designated as first choice for jobs. Next in preference are residents of the city or county in which work is to be done and third in order are residents of the state not living in the county where the work is located."

The regulations also provide that the state highway department shall do one representative construction project by direct labor, in order to provide a comparison with contract work in cost and efficiency. Contractors will be required to use hand labor where it does not interfere with sound economy and public interest. All contractors who violate the Federal regulations will be barred from further participation in the emergency road work.

Safety in the Construction of Radio City

HERE are some of the safety provisions carried out in the construction of the famous Radio City in New York which helped materially in preventing accidents:

Special gloves for all employees engaged in tearing down the three entire blocks needed for the project.

White socks also provided, to avoid infection from stepping on nails.

The use of a dust trap in the excavation work to prevent dust poison diseases.

Automatic safety brakes on all hoisting machines.

Two extra steel guys on each derrick.

Goggles for all men drilling or burning steel.

Metal-tipped shoes wherever needed.

A special clean-up squad for picking up loose bolts, metal scrapping, etc.

Steel construction work not permitted on rainy or windy days.

Use of patent scaffolds with roof protection.

Fire helmets used in dangerous places as a protection against falling objects.

Full-sized wire mesh doors for all elevator openings.

Catch scaffolds erected on the exterior of the building to protect workmen below.

Special heavy-duty material hoists for limestone lifting.

As a result of these provisions and a continual educational campaign carried on during the work, a fairly low accident rate was realized. Compensable cases averaged about one for every 20,000 man-hours of work.

Fast Dirt Moving

in

Tight Cut

With Three-Quarter Swing the 1¼-Yard Bucket Handed 1½ Yards Each Time

A 4.65-MILE concrete road job just south of Baltimore, Md., on the shores of Chesapeake Bay at Fort Smallwood, was awarded to Christhilf & Ensey of Baltimore, Md. They gave a subcontract to Potts & Callahan, also of Baltimore, for the grading which was in sand and sandy loam. The grading contractor put on a Marion 450 1¼-yard shovel powered with a Buda diesel engine and a 1-yard Link Belt shovel with a Waukesha motor.

There were 45,000 yards of sand and loam to be moved with the cuts running to about 10 feet maximum and the fills to 5 feet. The hauls were 700 feet average and well balanced with the cuts. Because of the character of the soil and the fact that the shovel had to make many three-quarter swings the contractor kept it on two wood mats all the time, with a third mat in reserve to swing in front when moving up to the face. In the 10-foot cuts the shovel worked with four White trucks equipped with dual pneumatic Kelly tires and Wood hoists. The trucks went up to the shovel at an

The 1¼-Yard Shovel Secure on Its Mat Is Here Shown Digging and Loading

The 1-Yard Shovel Starting the Thin End of a Long Cut—Only One Foot of Stripping

angle and received three heaping dipper loads in 45 seconds and turned away just as the next truck drove up for its load. The timing of this operation was excellent and there was no waste time for the shovel nor were there too many trucks eating into the profits. The trucks shuttled to and from the dump, backing away from the shovel. The shovel handled 900 yards per 10-hour day, swinging way around. When the loading was behind but where the trucks could drive across the rear of the shovel, the loading ran as high as 1,000 to 1,500 yards in the same time.

MAKING THE FILLS

On the fills there was an old darky who seemed instinctively to know where the next load could best be placed to give the 8-inch layer required by the specifications. The layers were not rolled but the constant traveling of the trucks and other equipment compacted the fills sufficiently. A Caterpillar Sixty with a La-Plant-Choate bulldozer spread the dirt on the fill and pushed it to the side as required. There was no confusion on the dump as the dump man seemed to have the faculty of letting the truck drivers know just where they were to dump and the bulldozer just where to spread at the proper time so that no two pieces of equipment were heading for the same place at the same time. The dump man was constantly on the move, pulling out roots which were excluded from the fill by the specifications, kicking a lump of dirt here and sizing up the condition of the fill in relation to the stakes. He also set the intermediate stakes from the engineer's stakes as a guide for the dumping.

A Caterpillar Sixty ahead of the fill pulled the stumps and handled the Caterpillar grader with an 8-foot blade and on the rare occasions when a truck ran too far onto the edge of the dump and could not pull out, the tractor pulled it back. For use in the sandy stretches where the trucks mired, the contractor used two Biehl crawler wagons with 7-yard bodies. These were pulled by the Sixty tractor.

PERSONNEL

Potts & Callahan, Baltimore, Md., were the subcontractors for this work with Walter Potts as Superintendent and Lee Crawford as Foreman. Particular attention was paid to the condition of the equipment on the job. All of it looked as though it were nearly new but the trucks were from one to eleven years old.

One Mile of Welds Strengthens 47-Year-Old Bridge

FOR nearly half a century the Charles Street Bridge, Baltimore, has been carrying an increasing amount of traffic,—a load for which it was not designed. Recently, by replacing the old stringers and welding stiffeners to the beams, the safe load of the bridge was increased and the structure made as strong or stronger than when new.

With a span of 117 feet over Jones Falls, the bridge was constructed of four wrought iron trusses, on top of which were floor beams, stringers, buckle plates, concrete fill and asphalt paving. From time to time the asphalt paving has been repaired and added to, increasing the weight to considerable extent. A thorough examination of the bridge was made which revealed a serious deterioration in the buckle plates and stringers. Bolts had been used in the old construction to attach the stringers to the floor beams and corrosion had attacked this portion of the bridge to such an extent that it was no longer able to carry safely the loads required of present day bridges.

Plans and specifications for the bridge were prepared by the Bridge Division of the Bureau of Highways. It was decided to use the shielded arc process since this would allow maximum utilization of the existing sound steel work, because it would provide joints stronger than the plate metal, and because it would make possible speedy repairs, and thus shorten the period of closed traffic.

The paving, concrete fill, buckle plates and stringers were removed and the original trusses found in excellent condition. Floor beams were strengthened by the addition of a steel plate 7 inches wide x ¾-inch thick arc-welded to the beam. New steel stringers were welded in place. This eliminated the punching of holes in the floor beams and made the beams and stringers essentially integral.

The old-type buckle plate and concrete fill construction was replaced by a newer form of bridge decking, the Belmont interlocking channel floor. Asphalt bridge planks were placed on top of the deck. Such construction effects a reduction in the dead weight of the structure and a reduced load on the trusses.

More than a mile of welds were laid by the welding contractor, the Acme Steel & Engineering Co., using Lincoln motor-driven welders and Fleetweld electrodes. The general contractor was Pecora & Gaskill Engineering Construction Co.

Minnesota Awards Contracts for Oiling of State Highways

CONTRACTS for the application of 3,530,000 gallons of road oil and tar to the state highways of Minnesota have been awarded to seven companies which were low bidders on the work. Five of the successful bidders are Minnesota companies. The total of all contracts is $40,242. The average cost of applying oil, based on this figure, will be slightly more than 1 cent a gallon, which is a fraction higher than bids last year.

The successful bidders were J. W. Craig Co., Minneapolis, 1,326,000 gallons; Metzer Jones Co., Deerwood, Minn., 736,000 gallons; Iowa Road Building Co., Des Moines, Iowa, 666,000 gallons; Gaus-Culligan Co., St. Paul, Minn., 356,000 gallons; Highway Engineering Co., Minneapolis, Minn., 246,000 gallons; Seneca Petroleum Co., Chicago, Ill., 200,000 gallons.

The opening article of the September issue of CONTRACTORS AND ENGINEERS MONTHLY *will describe the construction of a* 4,000,000*-gallon elevated water storage tank, reputed to be the world's largest, for the City of Sheboygan, Wis.*

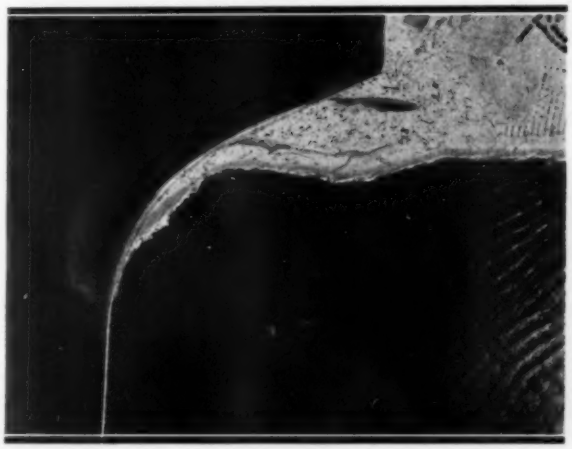
Building a Rock Jetty *to* Check Shifting Sand

8,400-Foot Structure Composed of Rock from 15 Pounds to 15 Tons in Weight Under Construction at Rockaway Point, Long Island, New York

BETWEEN 1835 and 1921 Rockaway Inlet on the south shore of Long Island moved 4 miles westward. Various theories have been advanced to account for this movement, the most likely of which is that a wave beating in from the southeast brings up some sand and then rolls down at the same angle carrying a certain amount of sand along. Colonel W. J. Barden, former Division Engineer, North Atlantic Division, U. S. Engineer Corps in a discussion of this phenomenon in *World Ports* stated:

"Erosion and westerly movement have been brought about by the combined action of waves, wind and current, the major part being played by the waves. On beaches remote from inlets, and except as affected by groins or otherwise, the sand is moved in a more or less zig-zag course along the beach by the waves from the east and southeast, striking the beach in an oblique direction. The tendency of all waves is to assume a direction parallel to the beach when approaching it, but heavy swells will continue to a certain extent the direction in which they are propogated. These waves set up a current immediately along the shore line in which material disturbed by the oscillatory movement of the waves is carried down the coast. This, together with the zig-zag drifting, appears to be responsible for the major portion of the sand movement." Colonel Barden further states in the same article that, "The volume of sand in the accretion of the Point between 1902 and 1928, taking an average elevation of the land surfaces as 10 feet above mean low water, was 5,500,000 cubic yards, or an average annual accretion of about 200,000 cubic yards."

The United States Government, after considerable study and realizing that the navigability of the Jamaica Bay inlet was seriously threatened by this constant movement of sand, decided that an 8,400-foot jetty which would cost between $800,000 and $1,000,000 should be built at the westerly end of Rockaway Point



A Photograph Taken June 3, 1933, by U. S. Air Corps, Showing Accretion of Sand Since the Construction of the Rockaway Jetty Was Started in December, 1931

to prevent, as far as possible, further shifting of these sands into the inlet.

STONE FROM SUBWAY AND QUARRIES

The stone for the jetty was delivered by deck scow and barge to two unloading docks on the inlet side of Rockaway Point. The core stone, ranging in size from 15 pounds to 6 tons, was obtained from excavations in New York City and vicinity and from a quarry near New London, Conn. The slope and cap stone, 6 tons and larger in size, was obtained from quarries along the New England coast, principally in the vicinity of New Haven and New London, Conn., and Deer Island, off Rockland, Maine. The run of the stone from excavations in New York City was not found to be sufficiently hard and durable for jetty construction and it was necessary to select the better quality of this stone for use.

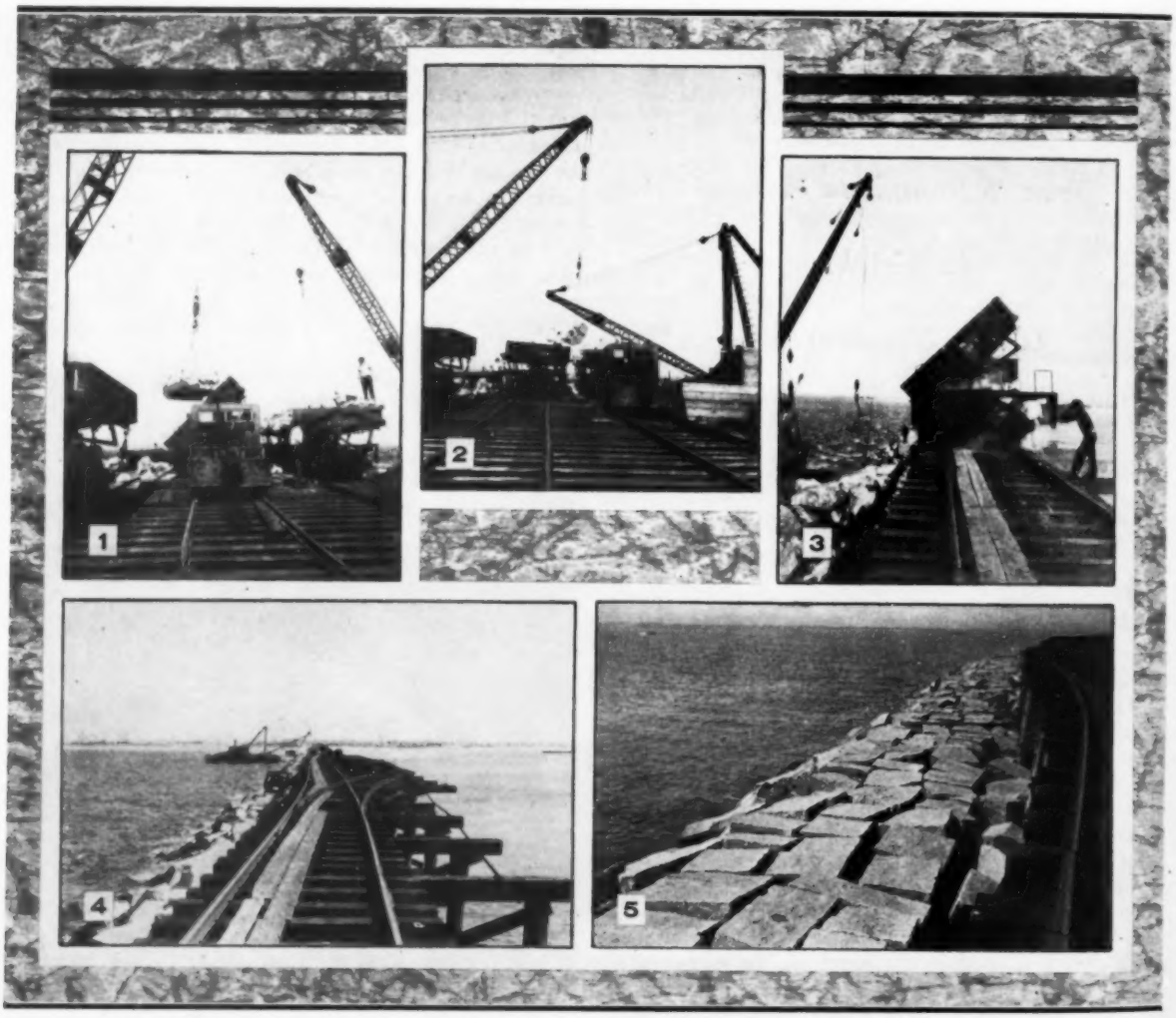
The smaller stone was unloaded from barges by steel skips and the larger stone by chains at either of the two docks. The southerly dock was equipped with two stiffleg derricks operated by three-drum Lambert and American hoists and one similar derrick at the northerly dock with a Lidgerwood three-drum hoist. Inasmuch as both docks were equipped with three tracks, a lighter was used to facilitate unloading at the northerly dock in place of another land derrick.

A central power house containing one 150-hp Erie boiler furnished steam for all of the land derricks, the steam being delivered through well-insulated pipes to each hoist.

HAULING THE STONE

Payment for the jetty was based on the tonnage of stone delivered so each load of stone taken from the barge to the jetty was weighed en route. The weight of stone which went direct to the breakwater from derrick barges and was not loaded on the train was measured by displacement of calibrated barges. Three dinkies were used for hauling, two 8-ton Vulcan gasoline-driven locomotives and one Davenport steam locomotive. Trains of Koppel pneumatic dump cars were used, one train being loaded at a dock while a locomotive was taking another train out onto the jetty to be dumped.

(Continued on page 29)



HANDLING ROCK AND TOP STONE IN THE CONSTRUCTION OF THE ROCKAWAY JETTY

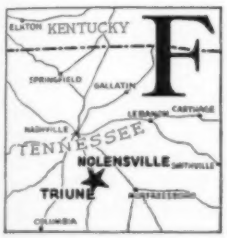
1. *Unloading smaller stone by skip.* 2. *Handling larger bottom stone by chain.* 3. *Dumping a rock train from the trestle onto the jetty.* 4. *A derrick boat setting top stone.* 5. *Top stone in place.*

Contractor Quarried Limestone

for Concrete Base

and Rock Asphalt Top Project

A Study of the Concrete Work on Project 256-A, Triune to Nolensville, Tenn.



FOR the sum of $163,922.66, William F. Bowe, Jr., of Augusta, Ga., was awarded the contract for the construction of 7.146 miles of combination concrete base and natural sandstone rock asphalt surface paving 20 feet wide with 5-foot shoulders on State Highway 11 in Williamson County, Tennessee, between Triune and Nolensville. The concrete base is a 7-5-7-inch section and the asphalt wearing course approximately 1½ inches thick.

The contractor was fortunate in leasing a quarry within ½ mile of the northern end of the work where he produced all the stone needed for the concrete work. The ledge worked ran from no depth to about 15 feet at the maximum depth. The stone was taken out in two lifts, using Sullivan rotators for drilling holes from 6 to 8 feet deep with air furnished by a Sullivan portable air compressor. The rock was shot with Hercules 40 and 60 per cent dynamite. Considerable stripping was necessary over the area of the quarry, which extended for about an acre, and the earth cover to a depth of 3 to 4 feet. This work was done by hand loading to 2-wheel tip carts.

Eight mule-drawn 2-wheel tip carts were used to haul the quarry stone from the face a distance of 150 feet to the 15 x 36-inch jaw crusher. This Diamond crusher reduced the material readily to the proper sizes which were raised by a Diamond 24-inch belt conveyor to the screens which discarded all stone above 2-inch and below ¼-inch by means of a shaker screen which worked rapidly. The entire crushing and screening plant was operated by a 50-hp Climax motor. The crushing plant was operated from February 1, 1932, until April 28 to furnish sufficient material for all the concrete of the job. The stone as produced was hauled by two 1½-yard Ford trucks to a long stockpile which was built up in 3-foot layers in accordance with state specifications.

Cumberland River sand from Nashville, Tenn., was hauled a distance of 18 miles and stockpiled parallel to the stone stockpile. By handling the two aggregates in this manner, it was possible to use one Koehring crane with a 45-foot boom and a 1-yard Blaw-Knox clamshell bucket to load all the material to the 2-compartment Blaw-Knox batching plant. The batching plant was moved twice during the work so as to reach the far end of the stone stockpile readily. The contractor hauled all the sand in two open-body trucks and also used for this purpose two tank trucks which had been built watertight for hauling the bulk cement.

The Bulk Cement Plant

The two trucks mentioned above with the watertight bodies were used to keep a constant supply of cement in the 300-barrel bulk cement storehouse. The house had a skeleton roof of 2 x 4's which were covered with two layers of tarpaulin at the first sign of rain and during humid weather. The trucks drove to the back of the storehouse and backed up a ramp built partly on the ground and partly on fill, delivering the cement as far into the house as possible. These trucks hauled 7 tons per load, the length of haul being about 20 miles each way. The trucks were loaded at the cement plant by the plant's Fuller-Kinyon pneumatic loader.

The cement from the job storehouse was taken by a screw conveyor which delivered it to the boot of the bucket elevator of the Blaw-Knox bulk cement plant which was operated by a LeRoi engine. A power take-off of the engine supplied power for a 2-cylinder air compressor which furnished air to fluff the cement when it caked in the bin.

QUARRY AND BATCHING CREWS

During the operation of the quarry the labor organization consisted of about 45 men. These were distributed between the quarry proper, the crushing and screening unit and the stockpile. For batching, the crew consisted of one craneman, three batchermen, and three men at the bulk cement plant. The average batches consisted of 1,350 pounds of sand, 2,334 pounds of stone and 496 pounds of cement.

BATCH-HAULING TRUCKS

The batch-hauling fleet consisted of twelve 3-batch Mack trucks, one International and one GMC 2-batch trucks. The contractor used Blaw-Knox Cementanks which were suspended within the batch compartments in the trucks with the gates pressed against the batch gates so that when the batch gates were tripped at the paver, the cement flowed out from the containers with the aggregate, effecting a fair amount of dispersion of the cement through the batch even before it was delivered to the mixer. A minimum of flying cement in the air when the batches were dumped into the mixer skip was also noted, due to the rapid covering of the cement with the aggregate when dumping.

FINE GRADING

The rough grading on this project had been completed under another contract a few years before and the road maintained as a gravel highway for some time. There were some cut-offs that entailed a small amount of rough grading for the paving contractor. Where rock was encountered in the fine grade, it was removed by blasting after drilling with Gardner-Denver jack hammers supplied with air by a portable compressor of the same make.

A very complete grading organization was maintained by this contractor for two reasons; first he believes in using equipment which will give the results with the minimum of time lost, and second there was on this contract a considerable variation in the rough grade and the final designed grade which entailed the removal of about 12,700 cubic yards of material. A Caterpillar Sixty, a Thirty and a Fifteen were busy handling a Killefer wheeled scarifier, an Adams No. 8 grader and a Western ½-yard fresno respectively. There were also a Euclid 2-yard Tumble Bug and a 12-foot Austin-Western leaning wheel grader which were the particular jobs of the Sixty to tote around in carrying dirt or in smoothing the grade. A Buffalo-Springfield 10-ton gas roller with a scarifier was busy ripping up the grade or compacting another portion of fill.

FORM SETTING

The fine grading and form setting were handled by the same foreman who was one of those slow moving individuals who never seemed to hurry but who had things done in short order while the other man was thinking about it. There were seven men setting forms, two men tamping them with tamping irons to insure a firm foundation, one form liner with two helpers, and one fresno man with a Fifteen tractor taking out the high spots after the forms were set and moving dirt forward or back to the low spots as shown by the cutting of the Lakewood subgrader or the secondary checking and cutting subgrader which was pulled forward by the men themselves. The remainder of the crew consisted of two form pullers who worked back and brought the forms forward on a skeleton wagon each day.

Immediately ahead of the mixer and between the point where the batch trucks turned through the forms to back to the mixer there were three men on final grade and a Fordson roller ironing out the truck tracks.

THE CONCRETE CREW

Although the concrete slab laid on this job was only a base, the concrete organization was as complete as on any paving job. One truck dumper with a length of pipe to trip the gates, and a whistle that talked, handled the trucks at the skip with remarkable skill and lack of confusion. A man climbed to the top of each truck and made sure that every bit of each batch had come out of the corners and that the cement had flowed from the container. The batches received a one-minute mix in the Koehring 27-E paver before being delivered to the grade. The operator handled the paver well and saw to it that it was oiled during the day.

The paver pulled a Carr grade planer along the 8-inch Blaw-Knox forms, cutting the final grade to the required cross section which had a 3¾-inch crown while the concrete had a 1¾-inch crown and a 1¼-inch countersunk curb 6 inches wide to hold the asphalt top in place. Two men shoveled the excess earth from the grade planer and four men handled the puddling and spaded at the forms.

The Ord finisher had both screeds equipped with a 1¼-inch plate which formed the countersunk curb as the screed worked its way across the slab and progressed forward. By using the countersunk curb formed in this manner, the contractor was able to save two men in his concreting organization, namely the curb builders, or if those men might be considered as also the finishers, then the two men who would be required to carry the concrete back to the builders may be considered as saved.

Two men handled the 10-foot longitudinal float from a double bridge built up by the contractor with pairs of 6-inch channels as the base along the forms. These channels which were set up back to back carried the wheels, which had Timken bearings. There was no belting behind the longitudinal float as the slab was used only as a base for the sandstone rock asphalt top and additional smoothness was not required. The rear bridge of the floaters had a heavy bolt suspended by a wire so that it dragged in the concrete, leaving a fairly straight mark which served as a guide to the broom man, permitting him to not overlap too much on the marking or roughening of the surface to provide a bond for the asphalt top. Another novel scheme to prevent argument on the lapping of the longitudinal floating was the insertion of a block between the pair of channels on one side of the double bridge at the midpoint. This marked the point where the bridge was to be stopped each time to give a 50 per cent lap on each floating operation.

As soon as the floating was completed, and it has been mentioned that there was no belting, the curb finishers completed the curb. Extra heavy tool steel bars 1¼-inch square, and 10 feet long with projecting pins for the clamps to attach to, were used as forms to finish the curb. The clamps were placed two to a bar

at one foot from each end. The use of the tool steel gave a solid piece of metal not easily disturbed in finishing the form but they were heavy and not easily moved forward. The curb crew consisted of a finisher on each side, a steel carrier on each side, and a man on each side laying the curb form bars. Immediately behind these men was the man brooming the slab with a wire broom with the wires tied in order to form firmer groups of wire to scratch or score the surface. The result looked similar to raking but the use of rakes was not advisable because of the tendency to dig in and disturb the aggregate.

Four men placed and sprinkled the strips of burlap which were 40 inches wide and long enough to extend over the edges of the slab on both sides. The burlap was sprinkled for 72 hours after placing and then removed and carried forward. The burlap was usually piled and wet down before being placed on the slab.

The organization described above was able under ordinary conditions, when rain did not interfere, to pour and finish 1,400 feet of the 20-foot slab in an 11-hour day.

WATER SUPPLY

Water for the concreting and curing was taken from a creek at about the middle of the job where it was impounded by a low dam. A Barnes triplex pump delivered the water the full length of the job in either direction through a 2½-inch pipe line with taps installed at 260-foot intervals. The paver carried 150 feet of hose equipped with Quick-as-Wink hose couplings to permit shifting the hose in a very short space of time without losing a batch of concrete.

PRIVATE TELEPHONE SYSTEM

This contractor used a privately-owned telephone system, consisting of wire strung on poles which belonged to the local telephone company and Western Electric magneto telephones with a ground circuit. These phones were placed at points of importance on the project, such as the paver, pump, field office and the State Highway Inspector's field office. As the main highway was under construction, the telephone system saved time in securing information in regard to the various activities or on breakdowns. It enabled the superintendent to communicate with the pump operator at all times in regard to the water pressure, with the supply house and the mechanic's shop and saved the partial expense of a service truck and mechanic's automobile. Without this system, it would have been necessary for some one to be constantly visiting the various operations to see that everything was functioning properly. Other than the initial cost of the entire system, which was approximately $200, the system proved very economical as the maintenance cost was practically nothing. This contractor has been using this type of telephone system for three years.

PERSONNEL

This work was done by William F. Bowe, Jr., of Augusta, Ga., with John E. Thomas in charge as Superintendent. For the Tennessee Department of Highways and Public Works the work was in charge of C. J. Greek as Resident Engineer.

Building a Rock Jetty to Check Shifting Sands

(Continued from page 26)

CRAWLER CRANES BUILT PILE BENTS AHEAD OF PLACING OF STONE

The track for the rock trains was carried out from the shore on pile bents placed 14 feet on centers. Each bent was composed of four piles with 12 x 12 caps and 3 x 8 braces. The piles ran from 42 to 47 feet in length and were driven by a Browning crawler crane. Down to within 1 foot of the cut-off the piles were jetted by a Domestic jet pump. Air for the McKiernan-Terry No. 6 air hammer which completed the driving was furnished by an Ingersoll-Rand 250-cubic foot compressor which was moved out along the bents by the crane as needed. The regular track stringers were made of 12 x 12's across which the track was laid.

PLACING THE STONE

From Station 0 to Station 41 the jetty was built 10 feet wide at the top and on 1:1 slopes outward. From Station 41 to Station 84 the jetty is 15 feet wide at the top and built out on 1½:1 slopes. The core stone was transferred from the loading dock over the trestle on side-dump cars and dumped in place from these cars. The slope and cap stone was placed by a floating derrick or lighter. This lighter placed the 15-ton cap stone after the base stone had been hand trimmed.

An unusual demonstration of the force of the current off Rockaway Point occurred at about Station 48, when the sweep of the current around the heavy base stone scoured out the sand and left two pile bents swinging in the air. This was corrected with the assistance of the lighter by placing stone around the base of the piles to stabilize the bents.

In November, 1932, when about two-thirds of the jetty had been completed, a severe storm destroyed 700 feet of the outer end of the trestle and tore off most of the remaining deck and track. This destruction was the result of one tremendous wave. Evidence of this was shown in the fact that the rails were lying in almost the same relative position on the ocean bottom as they were on top of the trestle instead of irregularly against the trestle and on the ocean floor as would have been the case if some portions had been torn out prior to others. The contractor chose to complete the jetty by depositing the coarse stone direct from barges with the aid of floating derricks instead of replacing the trestle.

PERSONNEL

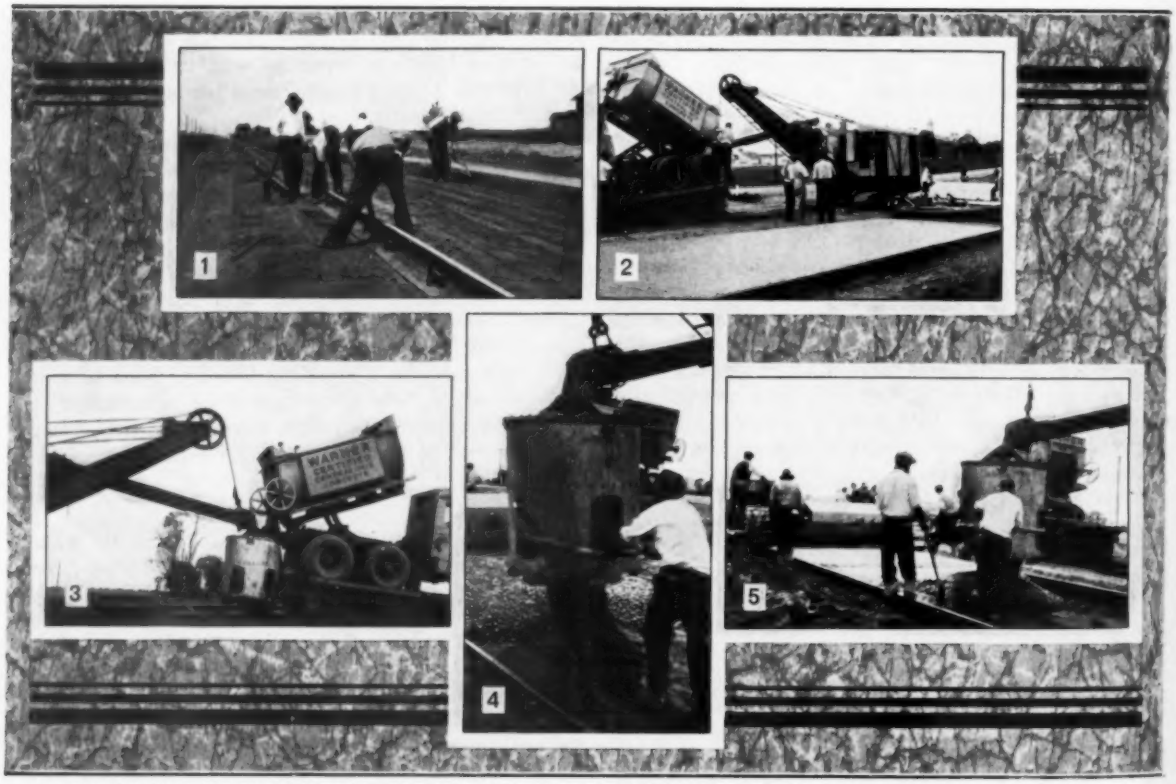
In December, 1930, immediately following the award of the contract, Merritt-Chapman & Scott Corp., New York, started assembling its equipment and on March 11, 1931, began placing the rock. During the winter, conditions are particularly severe at Rockaway Point because the fine sand driven by the winter winds cuts any exposed skin very quickly and painfully. For the contractor the work was done under the direction of George Burrows, Construction Manager, Tim Killen, Superintendent, and Con Coleman, Job Superintendent. The work was carried on under the direction of the First District Engineers, U. S. War Department, Colonel G. R. Lukesh, District Engineer, with A. E. Clark, assistant to the district engineer, in direct charge.

Paving with a Power Shovel

Vincent Schiavi of Buffalo, N. Y., Used Novel Method of Placing Concrete on New Dual Road in Delaware

NEW tools were used for handling the concrete by Vincent Schiavi, a Buffalo, N. Y., contractor, in paving the new Dual Road in Delaware, parallelling the existing du Pont Highway between Wilmington and Dover, a distance of 48 miles. When finally completed, the du Pont four-lane highway will carry south-bound traffic and the new Dual Road north-bound traffic in three lanes with a 30-foot grass plot separating the two highways. At present the new road is either finished or under contract between Wilmington and Smyrna, a distance of 36 miles.

The Schiavi contract is 1.79 miles from Farnhurst to School House Lane and was laid in three sections of 10, 11 and 10 feet respectively. The grade was prepared for the 8-inch Blaw-Knox forms and then, instead of using a paver, ready-mixed concrete was delivered from the Warner Co.'s central-mix plant at Wilmington, Del., in a fleet of Blaw-Knox open-top agitator bodies. The trucks, equipped with dual rear axles and a total of ten pneumatic tires, backed up on a ramp adjacent to the slab being poured and delivered the concrete to a 1⅛-cubic yard Blaw-Knox concrete bucket which replaced the standard digging bucket on a Lima 101 power shovel, as shown in the illustration. A one-quarter swing placed the bucket over the grade where one man dumped it and one puddler completed the spreading. An Ord finisher completed the mechanical equipment. With the central mixing plant approximately 5 miles from the job, the contractor unloaded, spread and finished one truck load of concrete every 3 minutes.



SCENES ON THE VINCENT SCHIAVI CONTRACT ON THE NEW DUAL ROAD BETWEEN FARNHURST AND SCHOOL HOUSE LANE, DEL.

1. Setting the 8-inch road forms. 2. The inclined platform with an agitator truck delivering concrete. Note the sheet metal pan for the concrete bucket and the cables for pulling both pan and platform. 3. A closer view of the concrete delivery. 4. Discharging the concrete from the bucket onto the grade. 5. The concrete crew.

The Editor Comments

Key Men Are Needed

Under the Federal rulings on labor performed on highways and other public work men cannot be employed more than 30 hours in any week. It does permit contractors to employ their superintendents for full time but the key men such as paver operators, form setters, and finishers on whom the contractor relies for the completion of a job in a satisfactory manner and for the maintenance of the reputation for quality workmanship which he has established over a period of years,—these men must go onto the 30-hour shifts.

Let us see how this works out. A contractor was awarded a job some 400 miles from his home town and wanted the men whom he has employed for years to accompany him and start the new organization going, set the pace and see that the reputation of the organization for speed and excellence of work was maintained. Seven men of his organization said frankly that they could not afford to leave home and maintain their families at home and keep themselves separately on the income from the 30-hour week. One of them had to take a job as a night worker at a small salary for six straight months of night shift in order to keep his family off the dole. He is a key man and one on whom the contractor relies to see that the job clicks.

It would be greatly to the advantage of the Federal government, the States and to contractors if they were permitted to use their key men on full time. The contractor could again see some profits ahead instead of having to suffer the penalty of taking a man labelled "finisher" on the county unemployment list and using him one day, only to find that the nearest he ever came to finishing a concrete pavement was to watch the finishers work as they completed a concrete pavement past his farm when he was plowing a couple of years ago and was resting under the old apple tree.

Look at it from another standpoint. If you are going to have a watch repaired you go to a man who has been in the business for a long time to be sure of the best care being taken of that piece of small machinery. Yet the Federal regulations require that the contractor take the man who applies as a "paver operator" and use him to operate and maintain a piece of equipment far more costly and in some respects just as delicate as our not-so-expensive watch. Is there justice in that requirement for any of the parties concerned? We agree that hand labor substituted for some of the work which we have done for many years with machinery developed for that purpose has done much to improve employment conditions in many of the sections of the country where there has been little or no work for two or more years. It has seemed an injustice to many of the manufacturers who make these specialized pieces of equipment but it is a fact that these very pieces of equipment developed for speed have not been used on more than one-third of the nearly four hundred contracts we have been visiting in the last five years. These contracts have been ones picked especially for us in many instances by the highway departments as well organized and well operated.

We must balance our thoughts on this gigantic problem. Labor must be served in as large numbers as possible without too great a penalty to the taxpayer and without penalty to the contractor who is staking his all on the jobs which he has been forced to accept at low prices and with extra labor burdens.

Subbing the Curing

There seems to be a growing desire on the part of contractors to handle the curing of concrete pavements by subcontract. From the contractor's standpoint it means that he is through with the job, except for the shoulders, when he has seen the slab finished. The curing is always a more or less nuisance operation, looking at it through the contractor's eyes. It is important enough to the success of the pavement as regards strength and wearing qualities but there are always the points of sufficient wetting of the earth or straw, sufficient cover, and enough men back of the finishers to handle the work satisfactorily. The contractor naturally puts his greatest effort into the pouring of concrete for all other operations are subsidiary to that as far as the income from the job is concerned. If he subs the curing, he lets the other man worry about those details.

Resident engineers, project engineers or chief inspectors are also welcoming the increase in the number of contractors who sublet the curing. They say that it definitely places the responsibility on one man for this work as a major operation and he has his men for that work and that work alone. He is not continuously shifting men away from curing for some other work and hence gives a complete job in full cooperation with the resident engineer. It looks as though subbing the curing will be a happy solution for an ill that has troubled both the contractor and the resident engineer.

Theodore Reed Kendall

Tentative Code for the Construction Industry

THE National Industrial Control Committee for General Contractors, representative of the general contracting business throughout the United States, has reported that an average reduction of 27 per cent in the working hours of construction labor and the establishment of local and regional minimum wages meeting the approval of labor itself are provided in the code of fair competition for general contractors which has been submitted to the Public Works Administrator. The code, when approved, will govern the expenditure of the $3,300,000,000 provided in the public works construction program, as well as all private construction during the next two years.

The proposed code provides for a 150-hour month, as compared with an estimated present average of 206 hours per month, for those who are working and for minimum rates of wages established, with the approval of the President, either regionally or locally by mutual agreements between truly representative groups of employers and employees. As a temporary stop-gap, or until the mutual agreements can be arrived at through collective bargaining, and be approved by the President, the code provides that the minimum wages established by the various state highway departments in conformity with the National Industrial Recovery Act shall be invoked. These rates have been used as the minimum of all Federal Aid highway work during the past year and, after an anticipated upward revision, will control the expenditure of an estimated $600,000,000 in road work during the present fiscal year.

The minimum rates, as at present set, average 35 2/3 cents per hour in the thirty-six states that have a statewide minimum wage for unskilled labor, whereas for the twelve states which vary the minimum within their borders, the average variance is from 29 1/3 to 41¼ cents per hour.

A. C. Tozzer of New York, Chairman of the National Industrial Control Committee for General Contractors and President of the Associated General Contractors of America, states: "It is intended that the minimum rates set by the states shall be used by general contractors only until mutually satisfactory minimum wages for each locality can be reached through collective bargaining in line with the spirit of the National Industrial Recovery Act. As these agreements are reached, one by one, they would supersede the minimum rates set by the states and eventually establish a nationwide system of minimum rates fairly arrived at through collective bargaining."

In addition to its revolutionary labor provisions, including compulsory attention to accident prevention and labor welfare, the proposed code deals drastically with practically all of the known competitive abuses within the general contracting business. It definitely outlaws the unfair systems of rebates and "bid peddling" and makes mandatory the filing of performance-records and credit information by general contractors and the keeping of adequate accounts showing the allocation of the funds received and disbursed on account of each improvement. It also provides that a general contractor shall pay all subcontractors, material vendors and others not less than their proportionate amount of partial payments made by the owner during progress of the work and final payment of the unpaid balance not later than ten days after the general contractor has received final payment from the owner.

To provide for administrative control within the general contracting business, the code establishes a National Industrial Control Committee for General Contractors which would have full authority to make all needful rules and regulations for the enforcement of the code's provisions. A similar committee, tentatively set up to negotiate and present the code, is composed of A. C. Tozzer, of New York, President of the Associated General Contractors of America, Chairman; W. A. Bechtel, President of W. A. Bechtel Co., San Francsico; A. P. Greensfelder, of Fruin-Colnon Contracting Co., St. Louis; Richard Hopkins, of Albany, N. Y.; A. E. Horst, of Philadelphia; Henry J. Kaiser, of Oakland, Calif.; James B. Kenny, of Denver; B. L. Knowles, of Worcester, Mass.; C. F. Lambie, of Amarillo, Texas; W. G. Luce, of Hegeman-Harris Co., New York; W. J. Lynch, of Chicago; A. J. McKenzie, of San Antonio, National Vice President of the Associated General Contractors; Charles H. Simpson, of Nashville, Tenn.; William Steel, III, of Philadelphia; Joseph A. Tomasello, of Boston; George B. Walbridge, of Detroit and David J. White, of Boston.

Standards and Specifications for Metals and Metal Products

THE Bureau of Standards, U. S. Department of Commerce, has recently published a 1359-page volume on the standards and specifications for metals and metal products. This book, which was prepared by George A. Wardlaw under the direction of A. S. McAllister, Chief of the Division of Specifications, contains the nationally recognized standards and specifications for ores, metals and manufactures except machinery, vehicles and electrical supplies. There are divisions devoted to iron and steel; iron and steel manufactures; ferro-alloying ores and metals and alloy steels and alloy-steel manufactures; aluminum, antimony, bismuth, cadmium and cobalt; copper, brass and bronze; lead, mercury and nickel; precious metals, metal jewelry and plates ware; clocks, watches and dials; tin and zinc; miscellaneous ores, metals, alloys and metal manufactures.

Copies of this book may be secured from the Bureau of Standards, U. S. Department of Commerce, Washington, D. C.; price $3.00.

A New Concrete Test Road

STARTING about the middle of June and continuing for several weeks, the Portland Cement Association has been building an experimental road of cement-bound macadam near Elmhurst, Ill., just west of Chicago. Sixty test sections are being built making a road 1,200 feet long. The construction of the road is aimed to secure efficiency and economy in the design and construction of cement-bound macadam and to develop practices that will permit cement-bound macadam to be used efficiently under practically all conditions.

Field tests will be reinforced by investigations in the Association research laboratory. Crushed stone, slag, and gravel will be used in the various test sections, with grout of varying consistencies. Included with many tests are the effect of vibration, as compared with rolling, in securing compaction and thorough penetration of the pavement.

A Scene in the Construction of the Experimental Cement-Bound Macadam Road Near Elmhurst, Ill.

A Contributor to *No. 5*

Construction Progress

PROGRESS in highway construction during the past half century has been marked, in an era that has demanded, and still does, the utmost in highway transportation facilities. For the past thirty years with the Lane Construction Corp., of Meriden, Conn., as its General Manager from its inception in 1902 to 1913 and as its President since 1913, William Rice Smith has been a very definite part of that progress, not only by his activities in his own company but also as a past president of the American Road Builders Association. This period has seen the growth of this company from an organization handling two or three contracts a year, aggregating perhaps $20,000 or $30,000, to one employing over 2,000 men who can construct some 200 miles of road per year involving approximately $6,000,000 to $8,000,000. This growth has been gradual, of course, and as sound as forethought and experience through several trying periods of business depression could make it, with results that are particularly gratifying in these times.

William Rice Smith

The scope of this work has necessitated an unusual amount of travel and innumerable personal contacts on Mr. Smith's part with the many members of the organization—a phase of his work which has been a source of great pleasure to him. The expansion of the company has naturally limited to some extent a very intimate knowledge of the field organization but it is very unusual, even with twenty or thirty jobs in action, when Mr. Smith does not visit them once a month. Interest in and a close contact with the members of the organization have characterized Mr. Smith as an executive throughout his association with this company, and it is interesting to note some of the features which have probably accounted for the fact that there has been such a very limited turnover in Lane employees above the grade of unskilled labor.

In the very early years of the organization it was the custom to give a turkey before Thanksgiving to all men over the rank of unskilled labor. The gift of this turkey was succeeded by the gift of a check, called by the employees a "turkey check." This check is mailed to employees over the rank of unskilled labor the week before Christmas. The company does not feel obligated to do this but the custom has been carried on continuously. The check is used for an adjustment of wages and also for the simplest sort of profit-sharing without any investment on the part of the employee. Mr. Smith himself assumes the responsibility for the amount of the check, his opinion being formed by personal contact with the recipient and extended discussions with the heads of the organization concerning the value of the men's work and their contribution to the organization.

Another feature, somewhat unique, is an organization formed by the employees called the Lane Friendship Club. The officers are elected by the men themselves; the dues are limited. The purpose of the club is to give prompt attention in case of illness or injury of an employee, or in the event of his death or that of an immediate member of his family, or on occasion of a birth, thus spreading friendship, help and cheer.

Of another event of the year at the Lane Construction Corp., Mr. Smith says: "Of the things I anticipate through the year, few ever give me more pleasure than our spring party at which time all of the superintendents and assistants congregate at the home office. These meetings, aside from affording enjoyment to all those in attendance through a personal contact that exists only at such times due to the wide distribution of the organization, have proved of material help through the development of a forum for the discussion and solution of the various problems encountered while carrying on our work. It also gives the engineers of our various districts an opportunity to talk to their men as a body of new methods, of opportunities for economy and safety, and through discussion to impress these ideas in a manner impossible otherwise."

The Lane Construction Corp. has carried a group insurance for its employees for several years, the major portion of the premium being paid by the company. Mr. Smith has also given liability insurance considerable attention with the result that the company enjoys a comparatively low accident experience. Continual effort in the way of posters conspicuously placed about the jobs, card inserts in pay envelopes, systematized lectures to and discussion of accidents with the superintendents and foremen on jobs have tended to lower the rating and keep the men safety-minded. In this connection, a substantial cash prize is offered annually to the superintendent having the best accident record through the year. This award is based on total number of accidents, hours of lost time, and cost, divided by the man-hours of work carried on his payroll. This competition has been very keen and close since its inauguration.

Mr. Smith believes that this policy has contributed very much to create the spirit of loyalty and cooperation which is existant in the organization, and the fact that so many of their men have been with the company for such long periods of service. The company has endeavored from the beginning to promote employees as rapidly as they were capable of taking increased responsibilities and in the present organization, every superintendent and assistant, with only one exception, has risen to that position from a minor one, getting their education in the business of road building as they went.

In speaking of the amount of activity and hard work made necessary by his position, Mr. Smith said: "The carrying on of work from my standpoint necessitates a tremendous amount of travel that at times grows irksome, but with it a variety I enjoy. In fact, to do anything wholeheartedly over a period of years a man must enjoy it; and while I am always ready to shut up shop in the fall, I am doubly anxious to get back into harness in the spring."

How the Other Fellow Did It

Ideas That Have Already Proved Helpful to Contractors

Expansion Joints Made Up Upside Down

248. In Iowa the specifications require that premoulded expansion joints be set with a cap and with dowels and transverse bars. A contractor operating in that state developed a machine for making up and setting these expansion joints which kept the men off the grade until the expansion joint was made up and actually put in place. The steel men made up the joints in the installing machine upside down. First the cap was placed in the machine, then the premoulded joint, followed by the dowels and the transverse bars, all of which were properly wired. Then light wires were tied around the joint to keep it in the machine when it was set up right side up. These wires were cut when the joint had been set in place and the concrete poured on both sides, then the machine could be pulled out without disturbing the joint. The cap was left in place until the finishing of the slab was completed. When the concrete had set sufficiently to permit edging along the expansion joints, the cap was removed. 24.4.36

An Effective Batching Set-Up

249. Whenever a batching set-up is criticised because the contractor has to back his trucks under the bin and perhaps again to the cement platform, his excuse is "no other method is possible." There are plenty of contractors, however, who carefully study their batching location and in nine out of ten set-ups arrange the bins and batches so that the trucks can drive through, which saves from 15 to 30 seconds per batch and consequently reduces the number of trucks necessary for hauling. A Canadian contractor developed a particularly efficient batching set-up by first building a cement platform 60 feet long by 12 feet wide which was roofed to keep out sun and rain. Tarpaulins were also kept in readiness to protect the cement in case of driving rain. At each end of the cement platform, the contractor built wooden bins beneath which were suspended the commercial batchers. Thus, a truck drove in beneath the stone batcher and received its three batches, then drove to the designated site on the cement platform where the 5½ bags of cement were ready for each of the three batches and then immediately again to the sand batcher. By this arrangement the contractor was able to handle about 400 batches a day with the minimum number of trucks as no time was lost backing into a pit under a batcher. Every move was ahead and in the direction of the job. A crane which served the two bins ran entirely outside of the truck roadway. 24.5.30

Gravel Dikes as Filters for Wash Water

250. A contract in northern Ontario called for washing glacial gravel prior to its use as aggregate for paving. As there was considerable marl in the deposit, the wash water was very turbid, and as marl does not settle out easily, the problem of getting a comparatively clean wash water in an area where water was at a premium became a problem. The contractor solved this by dividing a large excavation made the previous year into two sections. The smaller section was a settling basin in which the heavier portions of the marl settled out. The dike separating the two basins was of gravel and served rather effectively as a filter, greatly reducing the turbidity of the water flowing through. A New Jersey contractor used a similar method for removing loam from the wash water at his gravel washing plant but used about 50 feet of natural gravel as it lay on the ground as the filtering medium. 24.5.29

Flexibility in Design of Well Points for Subway Work

251. A subway contractor who was faced with considerable excavation below ground water level built up his own well points on a basic design which he developed so that there would be sufficient flexibility and the size could be readily changed to suit drainage and soil conditions. The screen was a fine punched bronze plate over a galvanized iron screen. A 1¼-inch pipe led into a 3-inch bushing and then into a 3-inch coupling which was connected with a 3-inch pipe 24 inches long, having a series of 1 x 5-inch slots over which the screening was spaced. Some of the screens were made up with an ⅛-inch iron galvanized iron gauze on the outside and a very fine copper screen inside. In still other screens, No. 8 gage wire was wound on a ¾-inch pitch to separate the mesh from the slots. Two strips of strap iron in the form of a cross acted as spacers to center the well point in a larger pipe which was driven first and blown with compressed air. Then the fine gravel was placed in between the two and the outer casing withdrawn. 24.6.21

Spacing Transverse Reinforcing Bars

252. A quick way of accurately spacing transverse reinforcing bars was developed by a foreman on an Iowa paving job so that there was no opportunity for the inspector to have cause for complaint. A wood bar notched at the ends was used to give the correct spacing. It required but an instant for the man to place the bar on the last rod set and get the proper spacing for the next. On this particular job, the bars were supported at the end close to the form by tying to the longitudinal bar, and at the center by wiring to the center longitudinal bars. At the middle of the transverse bar a removable support with a handle was used and this was withdrawn as soon as the concrete was poured. 24.3.27

A Novel Method of Handling Batches at the Paver

253. A New Jersey contractor using a fleet of hired 3-batch trucks delivered the cement on a separate flat bed truck direct to the paver skip. On arriving at the paver a batch truck would pass the paver on the existing slab, pull ahead of it and then back to the skip. Immediately following the truck came a flat bed truck with the cement. At the paver one man stayed on the cement truck to cut the wires on the bags, another handled four of the seven bags of cement and the remaining three were handled by the man who dumped the batches from the trucks. An extra man helped dump the batches and signalled to the truck drivers. 24.6.28.

Horizontal Sheeting

254. The method of lagging tunnel sections between H-beams and packing with loose stone has been applied effectively in subway work by some New York contractors. On one recent job where the average cut was about 50 feet deep, the upper section of the trench was timbered between H-beam vertical soldiers which were spaced 10 feet apart by 10-foot sheeting of 4 x 8-inch planks placed horizontally with 2-inch spacers between the timbers. These were placed against the outer flange of the H-beams. This system of sheeting saved lumber, permitted packing behind the sheeting and relieved at its source any sudden head of water that might come from a broken main or a torrential rain. 24.6.22

Construction Industry News

Portland Cement Association, 33 W. Grand Ave., Chicago, Ill., has announced the appointment of Frank T. Sheets as Consulting Engineer to the Association. Mr. Sheets was, until last January, Highway Engineer for the State of Illinois and directed that state's 11,000-mile hard road program. It was under his direction that an unbroken record in pavement construction was made in 1924 with the completion of 1,230 miles of concrete road during one year.

Coppus Engineering Corp., Worcester, Mass., has announced the appointment of W. S. Gain, 418 Lafayette Bldg., Buffalo, N. Y., as distributor for Annis air filters in northwestern New York and McKean and Potter Counties, Pennsylvania.

Chain Belt Co., Milwaukee, Wis., has announced the appointment of the H. C. Wood Machinery Works, 514 Bryant St., San Francisco, Calif., as distributor for the Rex line of construction equipment, including building mixers, cold patch mixers, plaster and mortar mixers, a complete line of diaphragm and self-priming centrifugal pumps and contractors' saw rigs. R. J. Cooper is in charge of construction equipment sales for H. C. Wood Machinery Works.

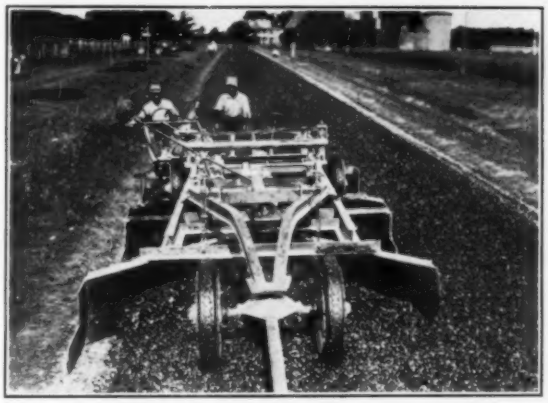
This company has also announced the appointment of the Brown-Bevis Equipment Co., Los Angeles, Calif., as distributor for Rex construction equipment, including Rex mixers, Moto-mixers, pavers, plaster and mortar mixers, pumps, saw rigs and cold patch mixers, in the Southern California district. This company is the successor of the Brown-Bevis Co., which has been in business in Los Angeles for nearly 20 years. Officers of the company are C. M. Weinberg, President; W. M. Parsons, Vice President and J. A. Beynon, Secretary and Treasurer.

Thomas G. Abrams, for the past 13 years associated with the Hunter Machinery Co. and the Keller Tractor & Equipment Co. of Detroit, has formed a company for the distribution of a complete line of construction and road building equipment. The address of Thomas G. Abrams is 2411 Fourteenth St. at Michigan Ave., Detroit, Mich.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced the appointment of L. W. Grothaus, formerly General Representative, to the position of Assistant to the President. His immediate duties will be to direct the company's interests in matters pertaining to the National Industrial Recovery Act as they relate to commercial problems. Walter Geist, who has been associated with the company since 1909, has been appointed General Representative.

Kron Co., Bridgeport, Conn., manufacturer of industrial automatic dial scales, has appointed the following distributors to handle its complete line of equipment: Ebbert & Kirkman Co., Inc., 321 Brown-Marx Bldg., Birmingham, Ala.; William N. Schwab, 783 East 17th St., Los Angeles, Calif.; and Coe-Mantes Scale Co., 420 Market St., San Francisco, Calif.

Ingersoll-Rand Co., New York City, has announced the appointment of L. B. Abrams, who has been Manager of the Boston office for a number of years, as Assistant General Sales Manager. Walter Bell has been promoted to the position of Manager of the Boston Office.



The Adams Retread Paver No. 2

A New Machine for Bituminous Road-Mix Work

A NEW and improved machine for bituminous road-mix work, known as the Adams retread paver No. 2, has recently been announced by the J. D. Adams Co., Indianapolis, Ind. This machine has a larger capacity than previous models and has a distinctly new feature in the steerable rear truck.

Equipped with three sets of mixing blades and a rear leveling blade, the machine mixes the aggregate four times in one trip. The accompanying illustration shows it mixing crushed stone and cut-back asphalt, the loose stone bulking 3 inches deep. The aggregate received two shots of bituminous material. A thorough mix was obtained after the first shot with three round trips of the paver and after the second shot, only three round trips were necessary, including the finishing round.

The paver has an independently operated rear levelling blade controlled by the man at the rear and center of the machine. This blade may be set to spread the material to the exact width, depth and crown, and the finishing round leaves the material smooth and ready for rolling. The operator at the side of the machine raises and lowers the mixing blades and steers the rear wheels which pivot like automobile wheels. The purpose of this steerable rear truck is to enable the operator to hold to a straight edge on the finishing round so that any off-line driving by the tractor operator is not reflected in the finished job. This steering feature also facilitates the proper distribution and finish on superelevated curves.

The machine is claimed to work equally well in stone, gravel or slag and with any bituminous material. The quick mix which it is designed to accomplish not only speeds up work and lowers mixing costs but is particularly adapatable for work with bitumen which sets up rapidly because the mixing is completed while the bitumen is still in its most liquid state. The machine will complete a mile of road per day. For the best results, a tractor of 60 horsepower or more is recommended for power.

Paving Brick Recommendation Available

COPIES of the revised simplified practice recommendation R1-32, covering vitrified paving brick, are now available and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. for 5 cents each. The 1932 revision, described in the current publication, has been recently reaffirmed for another year by the industry's standing committee. This simplified practice recommendation has been instrumental in reducing the number of varieties of vitrified paving brick from 66 to 6, or approximately 91 per cent.

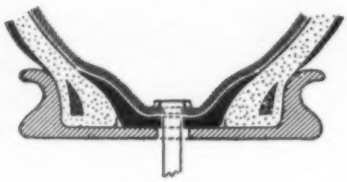


Figure 1

Premature Truck-Tire Failures Caused by Improper Rim Flaps

SUCCESSFUL operation of pneumatic truck tires and tubes requires the proper size flap for various tire and rim combinations. The correct flap for any assembly is governed by the bead construction of the casing and the rim on which it is mounted. In the production of pneumatic truck tires, each size tire is designed and manufactured for a certain size of rim. In other words, the beads of the tire are so made that when the tire is mounted on the size rim it is designed for, the beads seat firmly and are in proper position as shown in Figure 1.

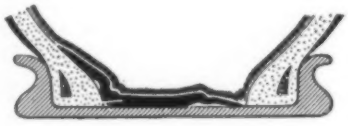


Figure 2

It is impossible, however, to equip truck casings at the factory with flaps which will meet all the wide and narrow rim mounting practices used in the field. The best that can be accomplished is to furnish the proper flap for the standard or most popular mounting and then depend on distributors and their organizations to make the necessary changes in the flaps when the mounting varies from the standard practice, according to the B. F. Goodrich Co., Akron, Ohio. Failure to

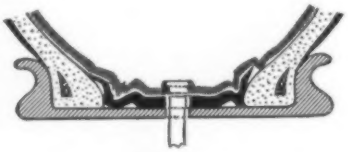


Figure 3

make these changes at the time a new tire is mounted on the rim or when the tires are changed from one mounting to another are responsible for many pneumatic tire failures.

A contractor in many cases loses confidence in the product as he does not realize that the cause of the failure is due to an incorrect assembly of the tire tube and flap. On the other hand, if the correct assembly is used and the tire delivers good service, he is entirely satisfied.

If the tire is mounted on a rim wider than the standard recommendation the flap is too narrow to cover the toe of the bead properly. It will either be so thin at this point that it will wrinkle or it will be off center far enough so that the tube will be in direct contact with the bead. Either of these conditions as illustrated in Figures 2 and 3 will cause failure at comparatively low mileage. When the tire is mounted on a rim narrower than the standard recommendation, the flap is too wide and the base which is cured to a definite profile becomes distorted as shown in Figures 4 and 5. The result is that the flap breaks, cracks and chafes very easily at the

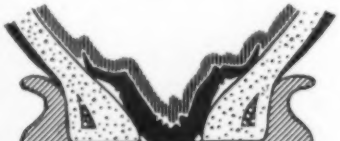


Figure 4

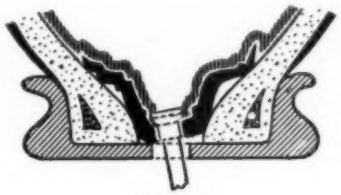


Figure 5

point of greatest distortion. In addition to crowded conditions between the beads, the valve stem and bridge washer become cocked, causing premature failure of the tube. Contractors, and mechanics who are responsible for the mounting and dismounting of truck tires, should become familiar with and follow these directions.

A Portable Diesel Power Unit

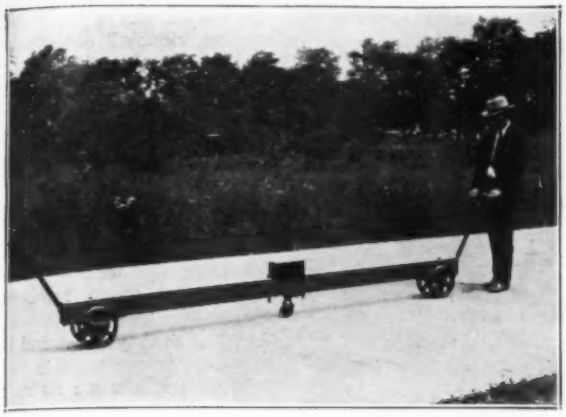
A COMPLETE self-contained portable diesel power plant for use with rock crushers, concrete mixers, sand and gravel plants, dredge pumps, air compressors, and similar equipment is manufactured by the Superior Engine Co., Springfield, Ohio. This unit costs little or nothing for installation and can be located anywhere, since it is independent of local water supply. It requires little space and, being of medium weight, can easily be moved from one place to another.

The plant has a steel I-beam mounting, including a radiator cooling system, auxiliary gasoline-engine-driven air compressor and air receiver for starting, fuel oil tank, lubricating oil tank, clutch and pulley. Air cleaners are provided on the intake to protect pistons and cylinders from excessive wear due to grit and dirt in the atmosphere. A substantial steel canopy covers the complete equipment.

The Superior portable diesel power unit is guaranteed by the manufacturer to consume not over 0.45 pound of fuel oil per bhp hour when operated at rated load. Diesel fuel oil costs from 4 to 7 cents per gallon, so the 100-hp unit may be operated at full rated load at a cost of from 24 to 42 cents per hour. With the Superior diesel there is no crank case dilution and the lubricating oil consumption is guaranteed not to exceed one gallon per 2,500 rated horsepower hours.

The engine, which represents the latest in modern diesel design, is built for heavy-duty and continuous service with the crankshaft and other principal members oversize. Construction is en bloc, with removable hone-finished cylinder liners. The simple fuel injection system permits variable speed when desired. Fuel pressure varies in direct proportion to the speed at which the engine is operated, a feature of the Superior diesel which is designed to insure perfect combustion and firing under all speed and load conditions. The full pressure lubricating system provides ample lubrication. The engine is completely enclosed, to exclude grit and dirt from operating parts and yet is perfectly accessible. Centralized control and indicating gages are located directly before the eye of the operator. The engine starts from cold by compressed air in a few seconds in any climate or temperature.

These units are made in models of three to six cylinders of 65 to 135 hp at 700 rpm, three to five cylinders of 85 to 145 hp at 400 rpm, three to five cylinders of 130 to 215 hp at 600 rpm.



The New Hill Surface Tester

A New Surface Tester

THE Hill surface tester, a new precision instrument built strong enough to maintain its accuracy under hard usage, has recently been announced by the H & H Manufacturing Co., Elyria, Ohio. The frame is made of one piece of 9/64-inch thick sheet steel in the form of an inverted U. There are two wheels on each end mounted on adjustable Timken bearings. A simple pipe handle on each end permits the instrument to be operated in either direction without turning it around. The center or gage wheel is carried on adjustable bearings and is attached to a vertical shank sliding in bronze bushings within the frame member.

Carried on the upper end of this shank is an adjustable contact ring or disc. This disc is set at the factory and needs no further adjustment unless the frame should become bent through an accident. The outer edge of this contact ring extends into one of the notches in the sides of the square steel gage block which determines the tolerance permitted or to be measured and provides the contact to operate the buzzer. Gage blocks can be supplied for any three specified tolerances. The fourth and smallest notch is provided for testing the accuracy of the instrument. The direct and vertical connection of the center or gage wheel with the contact points is designed so that any motion of the wheel is imparted in identical amount to the contact disc. Batteries, buzzer and switch are contained within the frame, easily accessible, and are waterproof unless submerged.

By adding a third wheel of smaller diameter on the same axle as the end wheels, this instrument is equipped to test road forms or other narrow surfaces, the larger outer wheels acting as double flanges. Adjustable scrapers are provided for all wheels. A device for marking the irregularities on the surface being tested and a special material for making semi-permanent marking fluid can also be furnished.

An Improved Stearate Waterproofing

AN improved method of processing stearic acid waterproofing paste has been announced by the Master Builders' Co., 7016 Euclid Ave., Cleveland, Ohio, resulting in a new product called Stearox 30, which contains two and one-half times the amount of stearate that has been supplied by conventional waterproofing pastes for the past several years.

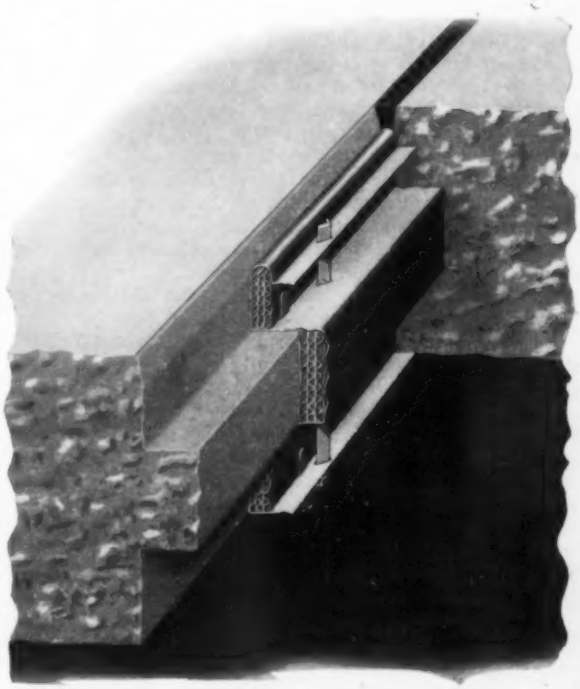
A builder with 1,000 yards of concrete to waterproof has had to use from 9,000 to 12,000 pounds of the waterproofing pastes that have been standard heretofore to get optimum results. By using only 3,600 pounds of the new Stearox 30 or 3.6 pounds per cubic yard or 0.6 pounds per sack of cement, he now introduces the same amount of stearic acid and obtains the same efficiency, according to the manufacturer.

Further major improvements claimed to be effected in this product are the elimination of ammonia or mineral salts that have been employed heretofore in manufacturing stearate pastes by the old process. Formerly, it was necessary to use these impurities, which were often detrimental to the quality of the concrete, in order to effect proper distribution of the stearic acid through the concrete. The new product is a straight stearate without impurities or adulterants of any kind. This new process has made it possibile to produce in a paste form easily usable a material of 30 per cent stearic acid as against 12½ per cent which was formerly standard.

A New Type of Steel Expansion Joint for Concrete Paving

AN expansion joint formed from sheet steel in any desired lengths and in heights and styles required by different paving specifications has been announced by W. S. Godwin Co., Inc., Race & McComas Sts., Baltimore, Md. This Air-Lock expansion joint has air spaces provided by inserted strips of waterproofed material held in place by clips stamped from the sheet steel. Each complete section is coated with asphaltic paint. The sections are set ½ to 1 inch below the pavement surface and are securely and accurately held on the subgrade by heavy steel stakes. The Air-Lock expansion joint virtually acts as a form while the concrete is setting. After the joint is formed in the concrete, it is sealed with hot asphaltic cement.

Air-Lock joints are designed to overcome unequal slab elevations and joint filler material forming a ridge above the joints. Each slab has a continuous horizontal bearing upon the adjacent slab, which bearing causes the ends of the slabs to function in unison under traffic. A positive seal at the top prevents seepage through the joint at all times, retains the subgrade support and does not form a ridge above the joint.



The Air-Lock Expansion Joint for Concrete Paving

The New Marion Clutch-Type Excavator Equipped with a 1¼-Yard Shovel

A New Series of Clutch-Type Excavators

A COMPLETE series of new clutch-type fully-convertible excavators, in the design of which have been incorporated mobility, versatility, long life and strength, has been announced by the Marion Steam Shovel Co., Marion, Ohio. These new Marion excavators are the straight-friction fully-convertible type consisting of a primary power unit, either gas, diesel, or a single electric motor connected through a master clutch and speed reducing mechanism, directly to the main machinery. Thus the various functions of hoisting, traveling, swinging, crowding and booming are independently controlled through friction clutches.

The crawlers are chain-driven and designed for full self-cleaning. Besides the two drive sprockets for each crawler, they are provided with intermediate rollers, one for each shoe to prevent the crawler belt from becoming tucked between them. These rollers are narrow and rounded to permit the shoe to tip sidewise to conform to the contour of the ground. All crawler bearings are sealed against dirt. The roller circle is of the live type characteristic of Marion design. In position, it represents a complete circle with the load applied top and bottom, similar to a roller bearing, thus keeping the load on the shafts to an irreduceable minimum.

Steering is accomplished by the operator from his position in the cab and with any position of the upper or revolving frame. Two levers operate through the center journal, one controlling the steering to both crawlers while the second lever controls two brakes which, when applied, are a chock preventing forward or backward movement against digging thrust. These brakes also act as travel brakes when required.

Only two horizontal shafts are used. The horizontal clutch shaft, which carries the swing and propel clutches, receives power directly from the power unit. This clutch shaft is mounted on anti-friction bearings and the entire assembly of bevels, gears and bearings is enclosed in an oil tight, cast steel case as protection against wear and misalignment. The hoist shaft is also mounted on anti-friction bearings. Two drums are mounted side by side and are driven directly from the horizontal clutch shaft. On these new excavators, external contracting band clutches that skip without overheating, take hold without grabbing or jerking and grip securely when entirely engaged, are used.

The boom hoist consists of a drum mounted in the main base casting and driven through a self-locking worm and wheel fully enclosed and running in oil. An automatic spring set brake prevents the boom from creeping down due to operating vibration. The shovel boom is of all steel construction. The dipper handle is of the outside type, combination of hard wood and steel. The boom for the dragline, clamshell or crane is latticed angle construction furnished with removable middle sections and the Marion standard full guard point to prevent cable fouling.

A Versatile Tool of the Bulldozer Type

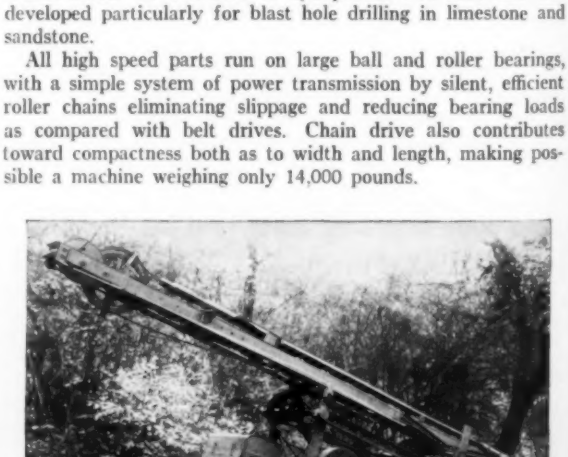
A NEW and versatile tool of the bulldozer type, which is claimed to be capable of being used for many purposes where the bulldozer can not function, has been announced by R. G. Le Tourneau, Wilson Way at Roosevelt, Stockton, Calif. The new tool is called an Angledozer and is actually a bulldozer capable of working at any angle to the tractor's line of travel. Its chief characteristics are its ease of adjustment to any angle of throw or of blade pitch, its light weight and its ability to work a continuous line, without backing.

The Angledozer is made with special and alloy steels liberally used wherever strength is required and all rigid junctions are welded. It is close-coupled, eliminating the subframe and bringing the blade back very close to the front of the tractor. The mounting by which it is attached to the tractor is very simple, without rubbing posts or complicated members.

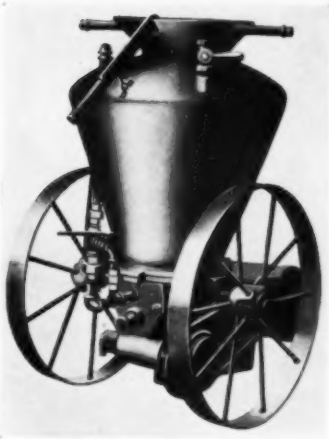
A New Blast Hole and Prospecting Drill

ALL steel construction, full crawler mounting, chain drive throughout, and dual spring shock absorbers for wire drilling are four of the features of a drilling machine recently brought out by the Keystone Driller Co., Beaver Falls, Pa. The machine is compact and sturdy, with over one-half its weight concentrated in the crawler assembly, giving a low center of gravity and stability on steep hillsides. It is claimed to be the first complete all-steel crawler-mounted drill made especially for drilling holes 6 inches or smaller in diameter. The machine may be used for drilling larger holes but it is stated that maximum economy is obtained in drilling 6-inch holes. It will drill to a depth of 900 feet and was developed particularly for blast hole drilling in limestone and sandstone.

All high speed parts run on large ball and roller bearings, with a simple system of power transmission by silent, efficient roller chains eliminating slippage and reducing bearing loads as compared with belt drives. Chain drive also contributes toward compactness both as to width and length, making possible a machine weighing only 14,000 pounds.



The New Keystone Crawler-Mounted Drill



The New One-Man Gunitor

A New Pneumatic Unit for Applying Concrete

THE extension of methods for the pneumatic application of concrete, cement-sand mixtures and refractory substances has been aided by a new machine for such purposes developed by the Gunitor Co., Elkhart, Ind. The new Gunitor unit may be used for the repair or restoration of all types of concrete, brick, tile, masonry and wooden structures, for buildings, bridges, seawalls, reservoirs, etc., for fireproofing steel and timber, and for repairing fireboxes, furnaces, cupolas, etc., with refractory materials. The Gunitor line includes one-man units operated by electric motors with electrical remote control. This machine can be charged by one man and started or stopped with remote control on a scaffold, in a boiler firebox, or from wherever the nozzle is being used.

Other new models are complete units such as the Combine-Gunitor, with a gasoline engine, air compressor, water pump and Gunitor, mounted on a steel towing chassis with solid rubber tires. Another type includes a pug mixer for combining ingredients and an elevating loader for charging the hoppers or chambers of the machine. The capacities of material range from 40 cubic feet per hour in small units to 250 cubic feet per hour in larger sizes.

Reduction in weight and in height increase the mobility of these units in restricted clearances, such as tunnels and mines, and at the same time charging capacities have been raised from 40 to 50 per cent. Electric welding is employed with steel plate to replace heavy castings; bolts, rivets and gaskets are similarly removed to decrease leakage and maintenance expense. These machines are also available for sand blasting with either dry or wet process. In the latter case, ordinary building sand can be used. The new Gunitor nozzles permit introduction of water so as to triple the amount of work which can be done per foot of air used. These machines as well as those for pneumatic application of concrete are offered for sale or lease without any restrictions of royalty or commission.

A New Crawler Tractor

THE new Allis-Chalmers Model K tractor which has recently been announced by the Allis-Chalmers Mfg. Co., Tractor Division, Milwaukee, Wis., develops a maximum of 48 drawbar horsepower and has a top speed of 4.5 miles per hour. At 2.08 miles an hour the model K develops 8,750 drawbar pounds pull. The 15-inch track shoes give a total of 2,010 square inches of track surface in contact with the ground, providing ample traction to hold the extra power.

In addition to the new power and speed, the drawbar has been specifically designed to stand the heavy blows of a direct-hitch 7 or 8-yard wagon. This drawbar also has a wide swing which materially lessens the side draft when pulling a blade grader. The engine is equipped with inserted valve seats which are made of special steel which has a high resistance to heat, with the result that the engine operates efficiently and valve grindings are reduced to a minimum.

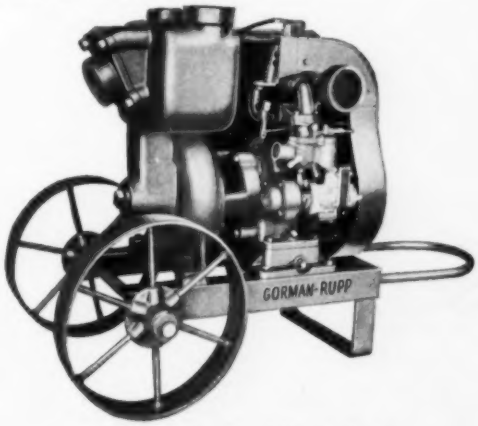
A Simple Self-Priming Centrifugal Pump

A NEW pump, claimed by the manufacturer to be the most simple self-priming centrifugal pump ever developed, is made by the Gorman-Rupp Company, Mansfield, Ohio. This centrifugal pump primes on an entirely new principle.

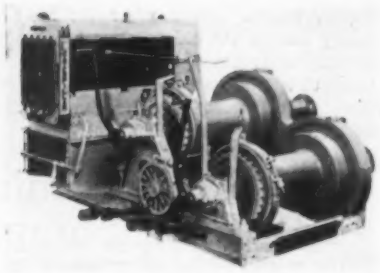
There is a water chamber so arranged in relation to the impeller chamber that when the impeller, which lends itself to the trash-type construction, starts to rotate, air is trapped on the frontal face of each impeller vane as it approaches the discharge from the impeller chamber by the water from the water chamber. Owing to the impeller's peripheral velocity and the exit angle of the impeller vane, the water and trapped air are pushed up over the conventional cut-off and into the water chamber. As the exit tip of the impeller vane passes the cut-off, the water from the water chamber drops down on to the intake end of the oncoming impeller vane and likewise traps air there, only to be pushed up into the water chamber where the air and water separate.

The above up and down movement of water occurs at the passing of each impeller vane and continues until sufficient air has been removed from within the pump to draw the water into the suction of the pump. Thereafter, the pump operates similar to any standard centrifugal pump. The oscillating movement of the water when priming and the regular discharge all take place through the one and only passage through the pump. There are no by-pass passages, by-pass valves, manual or automatic, floats, screens or the like required. It is claimed due to the absence of by-pass passages and their accompaniments, the blending into each other of the water and impeller chambers makes this pump a non-clogging pump. It is further claimed that it will indefinitely handle any solids, leaves, twigs, and similar material, 50 per cent larger than the openings in a standard strainer for the size of pump.

The pump is readily accessible as, after unscrewing six or eight nuts, depending upon the size of the pump, the combined impeller and water chambers, which are of unit construction, is readily removable. This exposes the impeller which can be easily screwed off the extended engine shaft and the sealing rings removed. There are no bearings in the pump and the oil seal, which replaces the customary stuffing box and packing, is claimed to last indefinitely even when the pump is handling water heavily charged with sand.



A Self-Priming Centrifugal Pump



The Lidgerwood Sixty Chain-Drive Hoist Equipped with a Caterpillar Diesel Power Unit

A Chain-Drive Hoist with Diesel Power

THE Lidgerwood Sixty improved chain-drive hoist, made by the Lidgerwood Manufacturing Co., Elizabeth, N. J., is now offered to the contracting field, equipped with a Caterpillar 4-cylinder 5¼ x 8-inch diesel power unit. This hoist can be supplied as single drum, double drum, or triple drum and with attached swinging gear on both double and triple drum hoists, for derrick service.

The drums in these hoists are 14 inches in diameter, with a 26-inch face and 26-inch diameter friction and brake flanges. The brakes are of the adjustable band type, asbestos-fabric lined, operating on ventilated polished brake flange on the end of drums opposite the friction. The frictions are operated by a hand lever and the brakes controlled by a foot pedal, all located within convenient reach of the throttle extension for controlling the diesel engine unit. For derrick service, the drums can each be fitted with two brakes, interconnected by a single brake lever.

All hoists are equipped with automatic mechanical brakes which automatically hold the suspended load while friction is engaged should there be any failure of power until the drum pawl can be engaged or the load brought under control of the hoist operator's service brakes. Equipped with the Caterpillar D-7700 diesel unit, these hoists are rated for a capacity of 5,400 pounds on a single line, one drum at a time, at a rope speed of 220 feet per minute.

A Portable 20,400-Gallon Pump

A 3-INCH self-priming centrifugal pump of the recirculating type, with a capacity of 20,400 gallons per hour with a 5-foot suction lift and 9,000 gallons per hour with a 25-foot suction lift, has been announced by the Chain Belt Co., 1666 West Bruce St., Milwaukee, Wis., to round out its line of Rex speed prime pumps. The Rex 3-inch pump incorporates the new self-priming device known as the Rex "prime control." With this simple mechanism the pump's recirculating system can be adjusted to assure maximum capacity and minimum priming time on any suction lift. The manufacturer claims that this new type recirculating system will pick up the prime in record time on any suction lift up to 25 feet and that it continues to pump with an air leak in the suction line that would stop an ordinary centrifugal pump but which only reduces the capacity of this pump.

The impeller is of the open trash type with two blades instead of the customary four. Power is supplied by a compact air-cooled engine developing 6 horsepower. The pump and engine are mounted on a wheelbarrow frame to provide maximum portability. Both pump and power unit may be removed from the frame by loosening four bolts. A ring in the top of the pump permits it to be lowered into a hole.

A New and Larger Diesel Tractor

THE largest and most powerful tractor in the Caterpillar line, the new diesel Seventy-Five, has recently been announced by Caterpillar Tractor Co., Peoria, Ill. It is powered with a six-cylinder valve-in-head Caterpillar diesel engine developing 80 horsepower at the drawbar and 93 horsepower on the belt at 820 rpm. The engine has a bore and stroke of 5¼ x 8 inches. It has a seven-bearing statically and dynamically balanced crankshaft, force feed lubrication to all crankshaft, connecting rod, wrist pin and rocker arm bearings, a large capacity air cleaner and fuel filters and positive, simple starting by means of a bendix driven by an auxiliary 2-cylinder gasoline engine mounted on the left side of the bloc.

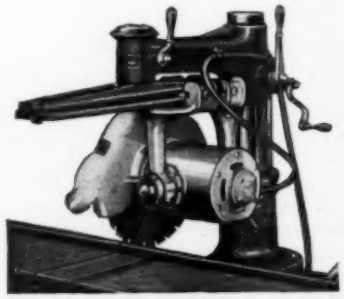
The tractor has eight speeds, six forward and two reverse, which are controlled through a single gear shift lever and provide working speeds ranging from 1.7 to 5 miles per hour. The machine weighs 30,550 pounds and has a ground contact of 3,515 square inches. Steering is accomplished through dry plate clutches each having 30 plates and a friction surface of 1,980 square inches. Extra heavy, heat-treated cast steel sprockets are employed and double idlers are held in position by cast steel yokes enclosing tandem recoil springs.

A New Saw for a Wide Variety of Work

THROUGH universal angular adjustment of the cutting blade and interchangeable cutters, the new Multiplex saw made by the Red Star Products Corp., P. O. Station D, Cleveland, Ohio, is capable of performing nearly all of the common forming, shaping or finishing operations on wood as well as the same operations on metal, tile, brick, terra cotta and a variety of other harder substances. Because the overhead track on which the cutting head slides swings from its center, which may be at all times directly over the work, there is no possible angle of miter, either right or left-hand, for which the whole 20-inch length of this track is not available. The table which slides in or out, allows the operator to keep the track directly centered over the work and permits easy adjustment of ripping up to a width of 21 inches.

The entire machine frame is made of certified malleable iron with its bearing surfaces ground and hand scraped to assure accuracy. The motor, yoke and guards are of strong aluminum alloy, with a dull sand finish.

Operations which are easily done on the Multiplex include ripping, cross cutting, mitering at any angle right or left-hand, beveling at any angle, dadoing at any angle or ploughing, compound angles of miter and bevel of every possible combination, paneling, molding and routing. For cutting metal trim, pipe or conduit, or for scoring brick, tile, slate or marble, the Multiplex requires only the attachment of the correct type of cutter and sometimes a simple vise for certain metal shapes. Either alternating or direct current may be used.



The Red Star Multiplex Saw